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Materials for Electrical Industry.

THE year just concluded has been a favourable one from the copper producers' point of view, as can be realised when it is remarked that at the close of 1927 the price of electro copper stood at £66 15s. per ton, and had advanced to £77 5s. by the end of 1928. To some extent, no doubt, the cause of the improvement in values is that the Copper Exporters, Inc., the organisation created about a couple of years ago to handle sales of the metal in markets outside of the United States, has got into its stride and, with little serious outside competition to fear, has been able to command its own figure. A further contributory factor, possibly, has been the working of the Copper Institute in America, which has enabled the producers to keep more closely in touch with the position of consumers and their probable requirements. What, however, has been the main cause of the improvement in values has been the large increase in the rate of world consumption of the metal. The deliveries of American refined copper during the period January/November (the latest data available at the time of writing) amounted to 1,523,089 short tons, as compared with 1,342,210 tons in the first eleven months of 1927. From this it will be seen that the world called for nearly 181,000 tons more copper during the first eleven months of last year than it did in the corresponding period of 1927. The American production of refined metal has also expanded, but to a lesser degree than the rate of consumption, the total production during the January/November period last year being 1,479,944 tons, as compared with 1,347,583 tons. In some quarters the impression has prevailed that a lack of sufficient refining capacity prevented the production from showing a greater expansion, but a more likely explanation is that producers were regulating output so as not to overtop requirements, and probably in so doing rather under-estimated the possible takings of consumers. At all events, the net result has been that the stocks of American refined copper have been reduced by something like 43,000 tons since the end of 1927. Latterly the production has been speeded up considerably, the November output being some 6,500 tons greater than the deliveries, so that equilibrium seemed to have been attained for the moment at all events.

Nevertheless, in the last week or so of the year further heavy buying was seen, which will reflect itself in the statistics later on, and the market closed the year with a firm appearance. In view of the increasing tendency in output, the consumption obviously will require to be sustained at a high level to absorb the metal. At present there is, however, no apparent indication of any slowing down in the rate at which copper is being used.

Lead producers during 1928 did not have a particularly satisfactory time. The highest price touched by prompt metal during the year was that of January 2nd, when it was £22 8s. 9d., while the lowest figure of £19 7s. 6d. on March 1st was the lowest since 1921. Indeed, the concern of producers became such that the question of concerted action for the betterment of the situation was discussed at a meeting of the leading producers held in London in September. At that meeting nothing definite was done, except to organise the collection of statistics, in the light of which the whole position will probably be reviewed at another meeting in March. The possibility of some curtailment of output brought about a temporary rise in values, which received further impetus from the shipping trouble in Australia, which occurred about the same time and resulted in a marked restriction of exports from that country. When the strike was over, however, and the accumulated supplies were being shipped, the market relapsed into a somewhat lethargic state, although it closed the year with a rather better tone. The outlook for 1929 actually does not look particularly bright, however, despite the usual end-of-the-year optimism. Supplies give every indication of being plentiful, while at the moment there is little to warrant the supposition that consumption will expand to any appreciable extent. However, the fact that another meeting of producers is being held in March gives a certain obscurity to the outlook, and prices may be influenced by sentiment.

Aluminium has gradually come to play quite an important part in the electro-technical industries, and some further progress was made in 1928. As, however, the aluminium market is very closely controlled, it is difficult to gain an accurate view of the position, but the reduction of £10 per ton in the price in May last can hardly be interpreted as a sign of strength, and demand has not increased materially since then. As a matter of fact, the European position seems moderately well balanced at the moment, but large stocks are reported to exist in Canada, which constitutes a menace to the general stability. Further increases in production are probable in the near future, and no great optimism can be felt regarding prices, for although consumption seems to be expanding gradually, there does not seem much likelihood of its overtaking production yet awhile.

Early in 1928 renewed dissatisfaction was expressed with the Stevenson restriction of rubber exports scheme, and the Government directed the Committee of Civil Research to investigate the matter. This resulted in an announcement by the Government on April 4th that restriction would be withdrawn as from November 1st. This announcement came as a blow to many, and prices rapidly fell to the lowest level touched since the inception of the scheme, and remained depressed throughout the rest of the year. It became obvious that estates, which under the provisions of the scheme, were only exporting 60 per cent. of "standard" capacity, would employ the six months or so before the scheme was withdrawn in tapping heavily and accumulating stocks. Efforts were made by planters to formulate a scheme, with the co-operation of the Dutch, for regulating supplies, but no satisfactory results were achieved. Owing to the low price of rubber, less reclaimed rubber was used, and with a record output of motor cars in the United States and elsewhere, consumption proceeded on a very good scale and stocks decreased substantially. With the removal of restriction, very heavy shipments began from Malaya, and in December stocks began to increase—a movement that will probably be carried on for some little time yet. The prospects for 1929 are rather mixed. No improvement is looked for in the early months, but if consumption continues to make headway as it is expected to do, the year may close with the market in a much sounder position than it is now.

Birmingham "Fair" Arrangements.

WITHIN about five weeks from the time of writing there will be great activity at Castle Bromwich and at the White City in connection with the British Industries Fair. Electrical men who have not already done so should at once mark off in their 1929 diaries the period commencing with Monday, February 18th, and ending with Friday, March 1st, as a time full of opportunities for the trade. Doubtless, the staffs of many exhibitors have already planned their arrangements so far as stands, goods, and personnel are concerned, and publicity departments are providing for advance advertising and literature appropriate to so outstanding an event. If exhibitors and their staffs who read these notes will give us early particulars of new or special products that the visitor can be on the look-out for, we will endeavour to give such information early publicity. The Fair is now recognised as an important electrical event which must be thoroughly prepared for, if the industry as a whole and in its individual parts is to reap a full reward. The whole of the electrical space available at Birmingham was booked many weeks ago—the space taken by the electrical trade constitutes a record, so that so far as size and variety can affect things success may be regarded as assured. What are needed to make assurance doubly sure, are plenty of visitors—buyers from overseas and buyers from all electricity areas at home; a good body of enthusiastic salesmen and stand attendants as well as technical representatives able to impart information; and a thorough-going optimistic spirit. Already we have published the names of electrical and associated companies and firms who are preparing to exhibit either in Birmingham or in London or at both places (ELEC. REV., December 21st, 1928, and January 4th, 1929). This information we are able to supplement in our "Business Notices" to-day, with a list of the electrical organisations which have as in previous years fixed upon certain days for their joint visits to and tours of the Electrical Section at Castle Bromwich. We would urge the individual members of the institutions and associations which have thus promised their co-operation, many of them being also officially represented on the Advisory Committee of the Section, to back up their leaders and see that these visits and luncheon events are largely and representatively attended. Already readers of the ELECTRICAL REVIEW overseas, however far away, have been apprised of the event in good time for them to make their convenient arrangements for visiting the Fair or for having it visited on their behalf by their agents here. We now urge those who are in the nearer foreign markets to make their plans without further delay. If in addition members of the electrical profession and trade in all parts of the Kingdom recognise that for them as well as for overseas buyers, Castle Bromwich will be the great centre of attraction, where they can see more representative British-made electrical products brought together than at any other place or time during the whole year, there should not be a dull day in all the eleven at Birmingham, while the general variety in London will ensure a continuous run of business there also.

Trade with the East.

THE conclusion of a new treaty between Great Britain and China lends added interest to the report of Mr. H. H. Fox, C.M.G., Commercial Counsellor at Peking, which we review elsewhere in this issue. Under the treaty, China is granted complete tariff autonomy, and in return promises to secure the

abolition of *likin*, arbitrary taxes and dues extorted by military and local "authorities" of all descriptions. This, if accomplished, will dispose of at least one of the obstacles to trade with China, but many more remain. These can only be surmounted very gradually by a continuance of firm government and a cessation of civil war. A prolonged period of peace, if it comes, will work wonders. First, it will enable the railways and roads to be reconstructed, and thus smooth the path of commerce, and after that it will make possible the vast transport and other developments which have been so long forecast but deferred again and again. Mr. Fox shows that the possibilities of trade with China are boundless, but the present state of the country is not such as to inspire confidence, though past history shows how kaleidoscopic the changes are. It seems that most of our visions of the great electrical advance that will ultimately take place must remain but visions for some time yet. It can only be hoped that the Nationalist Government will be strong enough to keep the forces of disorder in check, and thus justify the hope entertained by the "powers" in relinquishing part of the control which they have exercised over Chinese affairs for so many years.

In our issue of December 28th we dealt with a report upon another great Eastern market—India—by Mr. T. M. Ainscough, Senior Trade Commissioner in India. Here the difficulties with which British manufacturers and merchants have to contend are of an entirely different character. For over a century Great Britain has dominated the market; her relations with India were originally in the hands of a commercial concern—the East India Company, and this trading company ruled a large area of the country. In recent years, however, influences have arisen which threaten to lessen our supremacy. Native industry has become an important factor, while foreign competitors have strengthened their position in many directions. For several years past there has been a tendency for Government Departments and other public authorities to place their orders in India wherever this has been possible. Now definite rules have been drawn up which will compel Government Departments to do this, which means that the purchasing organisation in London will gradually diminish in importance, with a consequent loss to British manufacturers of the advantage which they have enjoyed for so long. Under the rules the orders will go to those concerns with adequate and efficient Indian organisations, whether British or foreign, although it may be expected that British traders will still receive some measure of preference.

Mr. Ainscough says that during the past six years he has been advising British suppliers of Government stores to expand their Indian organisations to meet the Government's requirements. It appears that most British manufacturers of machinery and engineering stores have already taken action in this direction. Those who have not done so stand in serious danger of losing important orders, for the trade is expanding, and they should hasten to attend to this vital matter.

The Indian prospect from the purely electrical point of view appears to be good. The latest figures, those for the period April-September. 1928, record substantial advances in imports of both electrical machinery and electrical apparatus. The total value of imports of both classes increased from Rs. 236 lakhs to Rs. 255 lakhs, and the proportion supplied by the United Kingdom from Rs. 171 lakhs to Rs. 177. While this is satisfactory, the fact remains that the British share did not increase in the same ratio as the total.

Industrial Electric Heating.

THE extent to which electric heating can be profitably used for industrial purposes is still far from being appreciated in this country; we have to live down the tradition that "electricity is dear," which was true enough 20 years ago, but does not hold good in our large industrial centres to-day. We have it on good authority that no less than two-fifths of the output of electrical energy in the United States is actually used in industrial heating processes. "Oh, yes!—Water-power," says the man in the street. We reply that long-hour loads can be supplied as cheaply from steam-driven generating stations as from water-power plant, and many industrial heating processes are essentially of this type of load. Moreover, merely to set off the cost of electrical energy against that of other heating agencies, without taking account of the incidental economies that it makes possible, is a purblind policy; the saving in labour alone often equals the cost of energy.

The development of nickel-chromium alloys for the heating elements of electric furnaces constituted a great forward step, and more recently the mounting of the elements inside the refractory lining fundamentally changed the situation, enabling large furnaces to be built and direct radiation to be employed, instead of passing all the heat through a wall of refractory material. Temperatures up to 1,000 deg. C. at least have become practicable, and new applications of electric heating are rapidly being made. One of great importance is that of heating pottery kilns, which has proved remarkably successful; another is the melting of non-ferrous metals, and the heat-treatment of alloys is constantly increasing in importance. Touching the last point, it is interesting to note that the new magnetic materials which have revolutionised submarine-cable practice depend entirely for the development of their singular properties upon accurate "heat-treatment" following a strictly prescribed cycle. For such a purpose the unique "controllability" of the electric furnace is ideally adapted, and the facility with which materials under treatment can be surrounded with an inert or otherwise suitable atmosphere is often of great importance. The precision with which the furnace acts ensures that "throw-outs" shall be a minimum, whilst the cleanliness and compactness of the electric furnace leave little to be desired. The absence of loss in flue gases is a great factor of economy.

Many of the foregoing remarks apply equally to baking and drying ovens, welding plant, water heaters, &c., and all these are well represented at the exhibition which has been opened at Manchester under the auspices of the British Electrical Development Association, and the local electricity supply authorities, whose enterprise deserves the warmest support—for this is another instance in which consumers, supply authorities, and manufacturers of electrical plant all stand to benefit by the development of the use of electricity.

Unique Electrical Developments.

THE potentialities of the large "store" as a load for the electricity supply undertaking are strikingly illustrated by the description which appears on our later pages of an installation of this type rated at no less than 3,500 kW, and believed to be the largest in the world; what is even more significant is the fact that for the heating, lighting, and ventilating of the establishment, estimates prepared for various systems by the consulting engineer, Mr. A. H. Barker, who is known to have no personal bias in favour of one method rather than another, showed that the all-electric system was the cheapest of all.

Another article in this issue, by Mr. R. E. Hopkins, B.Sc., discloses for the first time an ingenious solution of the problem of operating two-speed lifts on single-phase supply, which has so long been needed, but has hitherto eluded the efforts of inventors. We also give particulars of the remarkable turbo-generator which has been built to carry out the proposal of Mr. Georges Claude, to generate electricity by taking advantage of the difference between the temperatures of sea-water at the surface and at the bottom; that this is a practicable scheme is not open to question, but whether it is commercially practicable is another matter. Whilst wishing Messrs. Claude and Boucherot success in their venture, we fear that, as in the case of tidal power, the high capital charges incurred will prove fatal to it.

Copper, Lead and Rubber Prices.

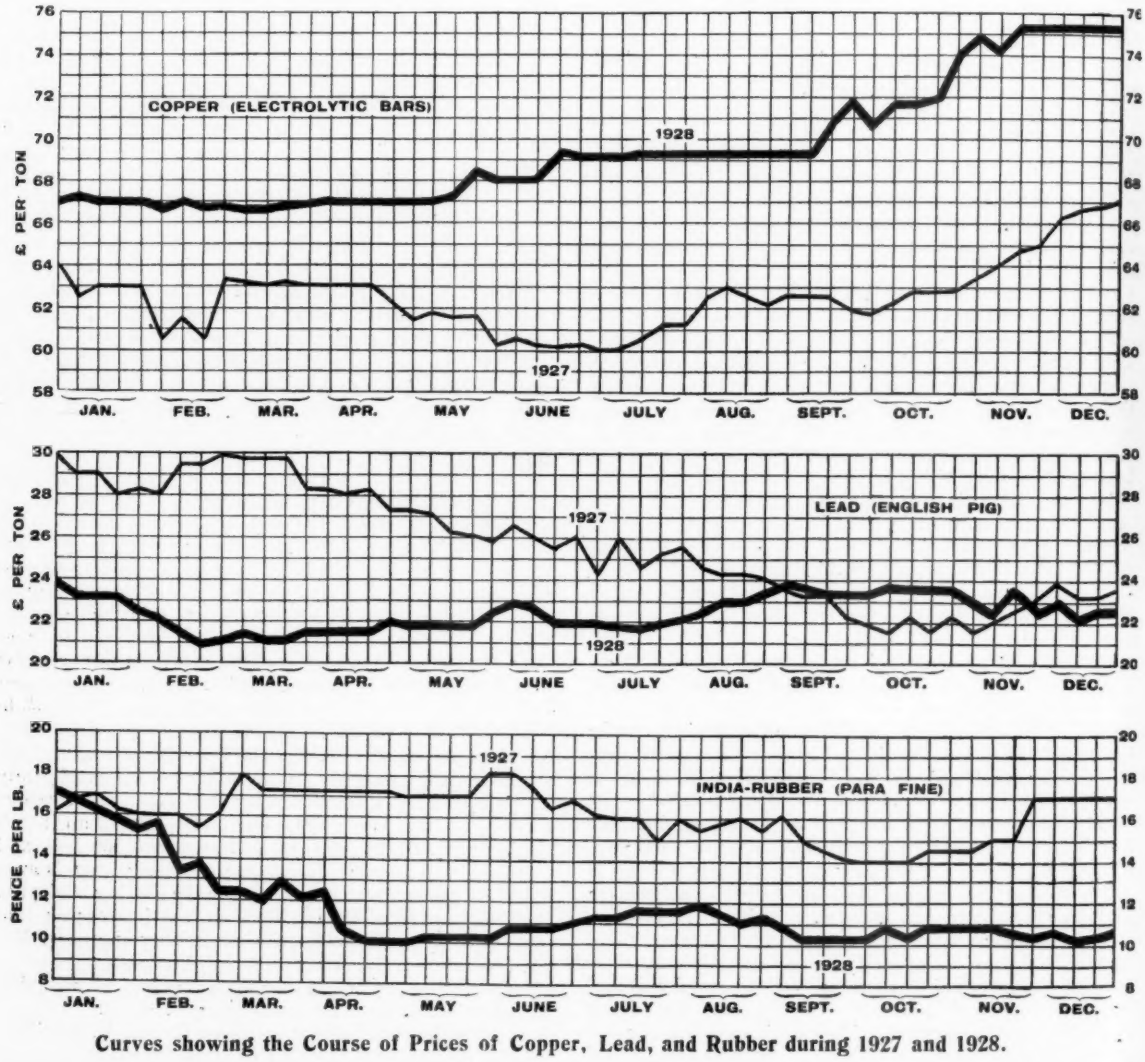
The Past Two Years' Movements Compared.

THE curves which accompany these notes illustrate the course of prices during 1927 and 1928 of three raw materials of importance to the electrical industry—copper, lead, and rubber. They are based upon the information given each week in our "Business Notices" section. Generally speaking, tranquillity characterised all three materials during the past year, copper moving evenly upwards and lead and rubber varying for most of the year between very narrow limits.

The price of copper, it will be observed, remained a few pounds above the corresponding level during 1927 throughout the year. For two clearly-defined quarterly periods the price changed hardly at all, but in September and October there was a substantial rise, which was maintained up to the close of the year. It may be recalled that during 1926 the price of electrolytic bars varied between £64 and £68 per ton. The average price level during 1928 was higher than it had been since 1923, when copper rose to about £84 per ton at one time.

The price of English pig lead was confined to the narrow limits of £20 10s. and £24, and the year closed with the metal at a lower price than in January. In that month the curves for the two years show a difference of £6, but this was reduced to £1 by the end of 1928. The average price, contrary to that of copper, was the lowest for many years.

After a long period of violent activity the price of rubber reached something like stability in 1927. For the first three or four months of 1928 it looked as though the activity was to be renewed; in that period the price fell by 6½d. per lb. Thenceforward, however, there was little change, and the price remained at between 10d. and 1s. per lb., finishing up about 6d. a lb. below the last price of 1927. The average price for 1928 was below that of 1924, when the extraordinary upward movement set in. In that year the price rose to 1s. 7d.; in 1925 there was a sudden rise, succeeded by a fairly considerable fall, after which the price sprang up to 4s. 6d. per lb.; and in 1926 there was a downward swoop, the year closing with rubber at 1s. 4d.



Curves showing the Course of Prices of Copper, Lead, and Rubber during 1927 and 1928.

A Large Heating, Cooling and Ventilating Scheme.

The electrical installation which is running satisfactorily at the premises of Messrs. Bourne & Hollingsworth, Ltd., Oxford St., London, was adopted because it was estimated to be cheaper in running costs than any other method.

THERE are many features of particular interest in connection with the electric heating, cooling, and ventilating system recently installed at the premises of Messrs. Bourne & Hollingsworth, Ltd., Oxford Street, London; probably the chief among these are the size of the installation—it is designed for an ultimate maximum loading of about 3,500 kW—and the fact that electric heating was decided on as a result of its being estimated to be cheaper in total running costs, including depreciation of equipment and cost of supervision, in the particular scheme in question, of course, than any other method. The installation is also believed to be the largest of its kind in the world.

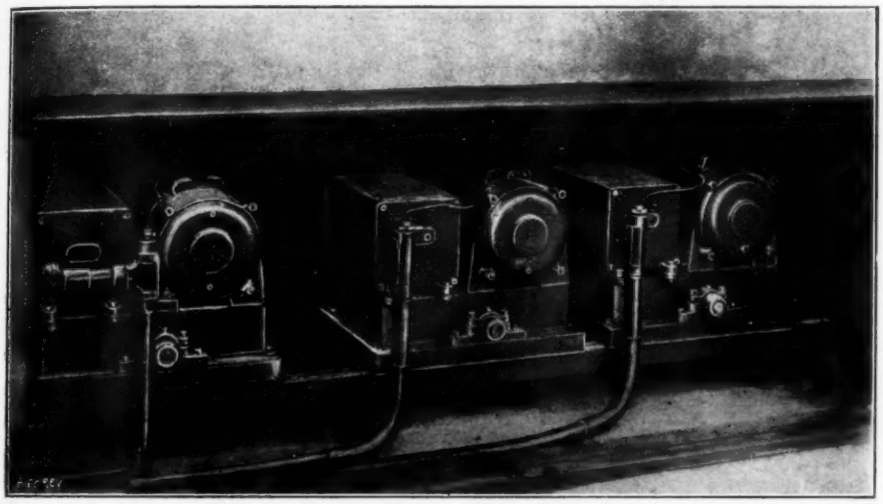


Fig. 1.—Bank of Three Damper-motor Units.

The scheme serves that part of the premises devoted more particularly to the selling side of the business, which has approximately a floor space of 160,000 sq. ft. and a volume of about 2,000,000 cu. ft. It is designed to maintain an average temperature of 62 deg. F. throughout the rooms and floors served, and to effect seven changes of air per hour. The general project was originated by Mr. H. Hollingsworth, and the scheme was designed by Mr. A. H. Barker, B.Sc., M.Inst.C.E., consulting engineer to Messrs. Bourne and Hollingsworth.

The operating principle employed is that of blowing hot or cold air, as required, into the various departments, the temperature and volume of the air admitted at the given points being remotely controlled from a central control room. To permit of such an arrangement it was necessary to incorporate in the design of the building a system of air ducts and sub-ceilings through which the air is conducted and admitted to the rooms. Fig. 7 shows a portion of the sub-ceilings in one of the showrooms on the ground floor.

The actual treatment of the air is effected by means of eight complete and separate heating and cooling equipments, four on the roof of the building housed in two double chambers, and four in the basement in separate chambers. At each of these the main air duct or trunk opens out to a large air heater of rectangular section, containing the heating elements, which presents to an air-inlet chamber an intake measuring about 6 ft. by 6 ft. A hand-operated flap door controls the main volume of air admitted to each system. At the outset the air taken in at each equipment is washed, and for this purpose a network of water sprays is arranged over the mouth of the intake. The cleaning water is taken from a storage tank

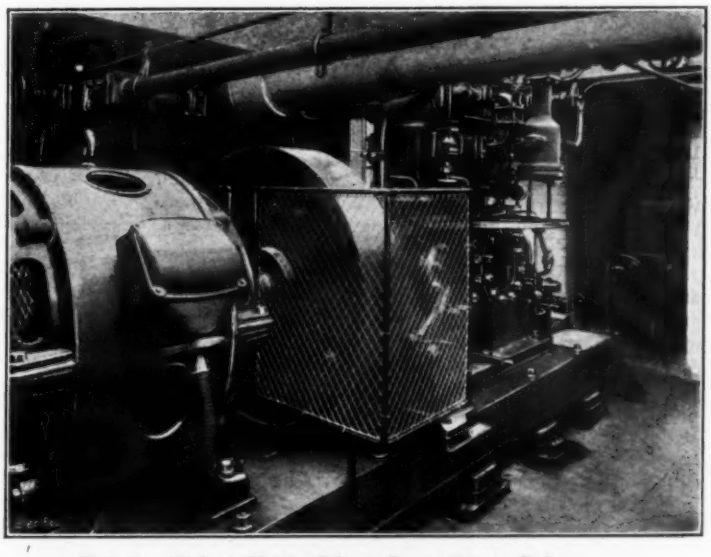


Fig. 2.—60-h.p. Motor-driven Compressor; Brine-circulating Motor at Rear.

on the roof, and is used over and over again, being itself cleaned every time it has passed through the sprayers. From these the water is collected in a well beneath, from which it is pumped through a filter and back to the storage tank. The two rotary pumps for forcing the water through the sprayers and returning it to the tank are driven by a 6-h.p. motor, one pump on each end of the shaft. Fig. 4 is a view in one of the double-equipment chambers, showing the two sets of pumps; the door-windows on the opposite walls afford access to and inspection of the main trunks at the intakes. In the basement only one water pump is installed per equipment, the water head from the storage tank on the roof providing sufficient pressure to force the water through the sprayers.

The clean air next passes through the elements, and these are arranged in banks sectionally through the heater. The elements are of simple construction, and consist of nichrome ribbon wound on strip mica, the

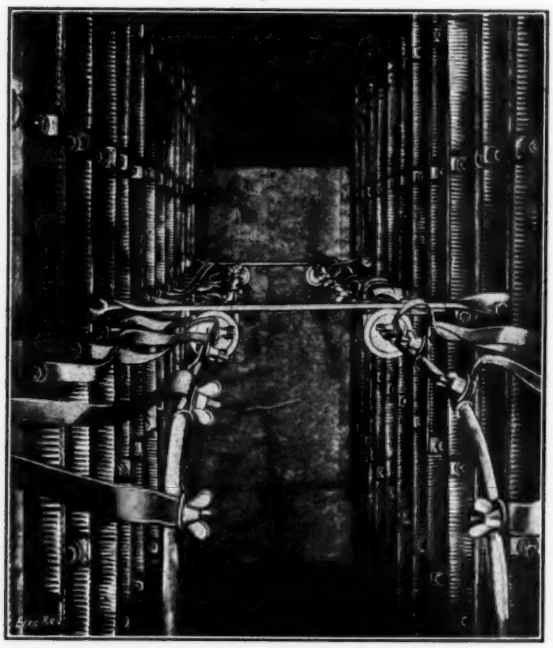


Fig. 3.—Heater Chamber Elements, from Side.

strips being carried on reel-type insulators mounted on iron bars. Fig. 3 is a view looking through one of the element chambers from the side, and showing two of the element banks or grids. There are six equally loaded grids per chamber, with a total loading of 120 kW. These are supplied at 230 V, between phase and neutral, and the whole is balanced up on the three phases. There is provision in each heater for additional elements up to a total of 360 kW. As already indicated, the elements are normally controlled from a distant station by means of push buttons, actual switching being effected by six triple-pole magnetic contactor switches; these are mounted in a street-type pillar. Fig. 5 shows the control equipment in one of the double-set chambers; the front pillars contain the contactor equipment for the heating elements, and others at the rear house the control gear for the pump motors. Local control is also arranged for the heating equipment, and emergency thermostat apparatus is provided to cut off the supply to the elements at a predetermined temperature. The circulation of the air is effected by fans, one 12-h.p. motor-driven unit, fig. 6, being arranged in each main air trunk. The fan motors are contactor controlled, and the contactors are electrically interlocked with those for the heaters, so that any bank or section cannot be switched on without the fan. Each fan will pass about 30,000 cu. ft. of air per min.

No doubt the success of the system is due largely to the efficient means of control of the temperatures in the various rooms, departments, and so on, and in this connection damper stations arranged at different points in the installation, by means of which the volume of air admitted at the various points can be accurately regulated, play an important part. There are 32 of these stations in all, and each consists of a simple flap-type damper driven by a ¼-h.p. motor. In fig. 1 is shown a group of three damper-motor units arranged in a small chamber on the roof of the building. These tiny equipments were specially designed for the job, and each consists of the motor, a very-high-ratio reduction gear, and a drum switch. This drum switch provides for six positions of the damper, and works in conjunction with a 6-way selector switch (through contactors), resembling the stud panel of a face-plate starter or rheostat; the switching-on of the motor is effected by the selector switch, and the drum switch cuts out the motor at the desired position of the damper. This is dependent on the "run" of the motor, which is determined by the length of the drum switch contact and, in turn, by the selector switch position. A group of contactor panels, starter switches, and push buttons for the local control of ten damper stations, and the condenser water pump, are shown in fig. 6.

When the air circulated is required to be at a lower temperature than that of the outside atmosphere, the necessary cooling is effected by means of the spray water, which is cooled by refrigerating plant. Two 60-h.p. motor-driven ammonia compressors, fig. 2, are housed in a separate room on the roof. The main washing-water tanks on the roof contain evaporating coils through which is circulated the cooled compressed ammonia, and which are capable of reducing the temperature of the spray water to 42 deg. F. The refrigerating plant has also more special duties to perform, and at all times of the year; for instance, the cooling of a fur store in the basement and of a number of food chambers. A 2,000-gal. brine tank also works in conjunction with the refrigerating plant for these purposes, the brine being cooled by evaporation coils and circulated where required by suitable motor-driven pumps. The brine can be cooled down to 16 deg. F. Fig. 8 shows a couple of 2-h.p. motors installed in the basement for circulating the brine through coils forming part of the fur-store cooling equipment. Air is blown through the coils by means of two 2-h.p. motors, fig. 9, driving fans. To secure the stability of the system, each fan motor and one of the pump motors are run in parallel on the same flues and brine pipes, but on separate electrical circuits, and each pair of motors is thermostatically controlled by the temperature in the fur store, so as to come "on" or "off" in correct sequence at predetermined temperatures. By means of a change-over switch the thermostat connections can be altered, so that the motors are not always switched on in the same order. An additional thermostat is employed to give warning in the case of current failure. The temperature limits for the thermostat controls are 32 and 34 deg. F. and 36 and 38 deg. F. respectively.

As already indicated, the success of the whole scheme is dependent largely on the system of control employed. From the control room are operated the motors, fans, heaters, and the baffle motors at the damper stations, so that the volumes and temperatures of the air at both the inlets and outlets can be regulated at will. Fig. 10 shows the two distant-control panels employed. The one on the left serves for the water pumps, fans, and heaters, and is equipped with selector switches for controlling the heaters and push-button apparatus for the pump and fan motors. The right-hand panel is equipped with the necessary selector switches for operating the baffle motors. It is, of course, necessary for the operator to be able to ascertain quickly and accurately the temperature at various points of the premises, and also of the air in the main trunk and heater chambers and of the washing and cooling water. To meet these requirements there are 50 thermometers

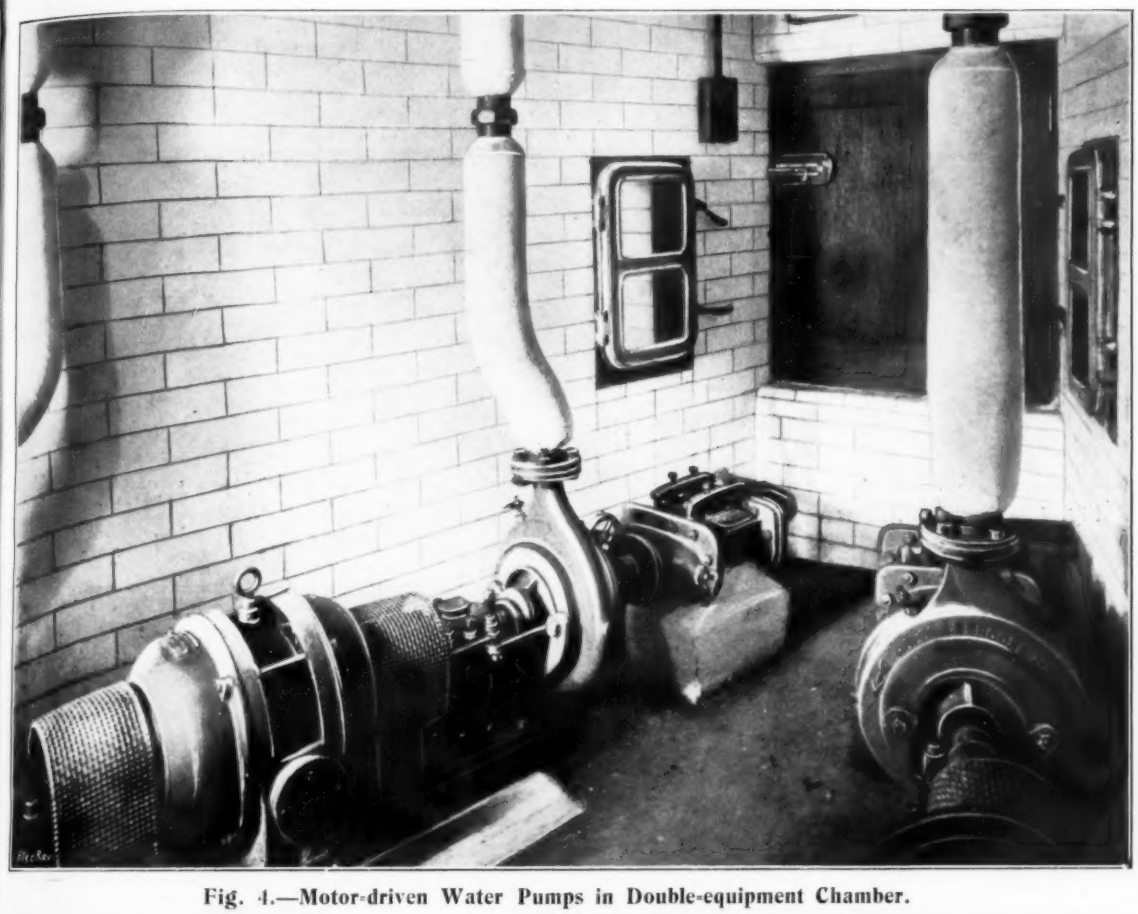


Fig. 4.—Motor-driven Water Pumps in Double-equipment Chamber.

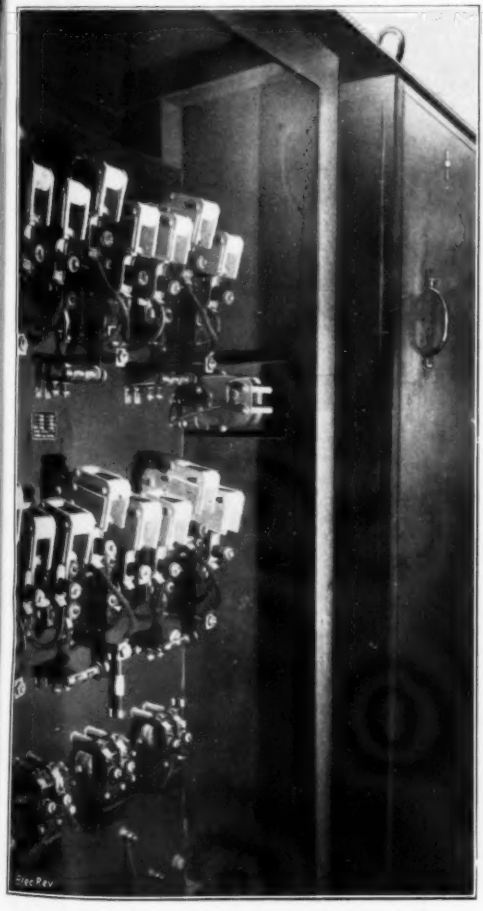


Fig. 5.—Contactor Gear for Heaters, and Switchgear Pillars.

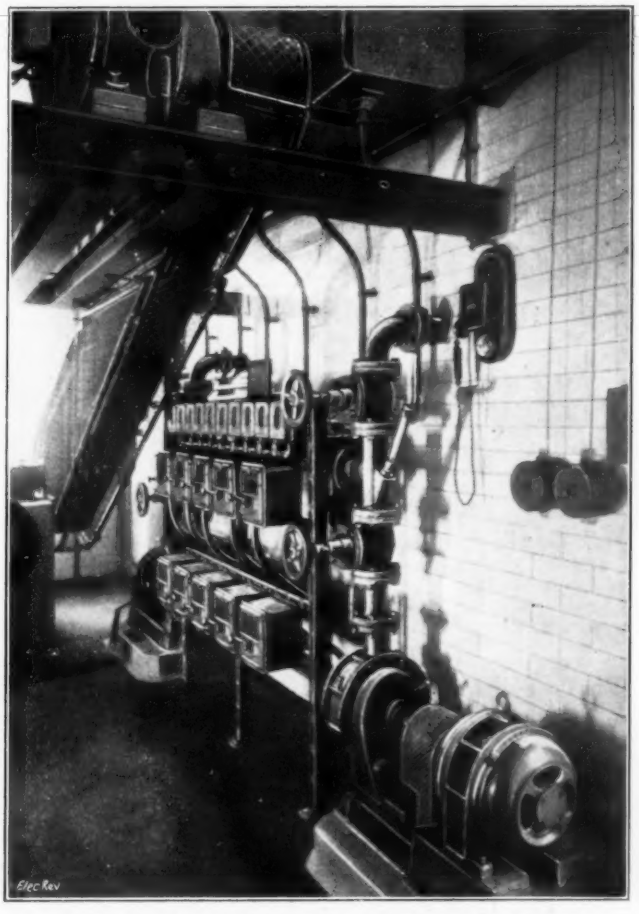


Fig. 6.—Fan Motor, and Control Gear for Baffle Motors.

Fig. 7.—Showroom, showing Sub-ceilings.

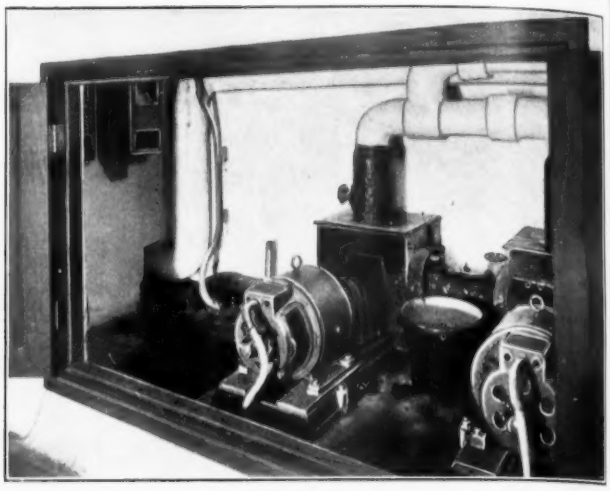


Fig. 8.—Fur Store Brine-pump Motors.

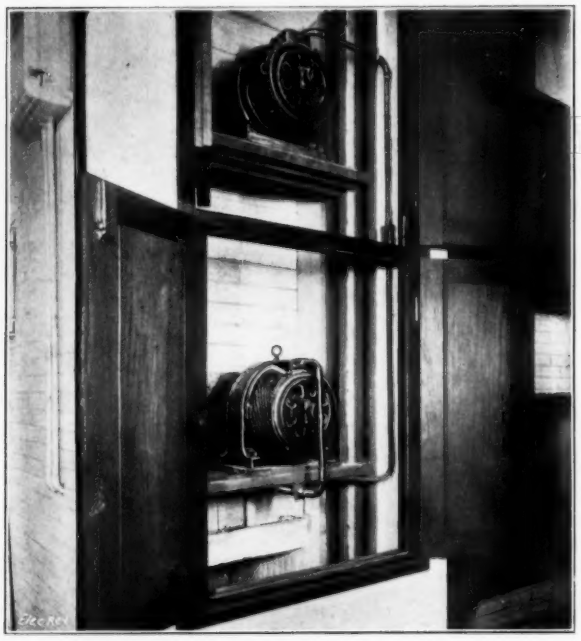


Fig. 9.—Fan Motors for Fur Store.

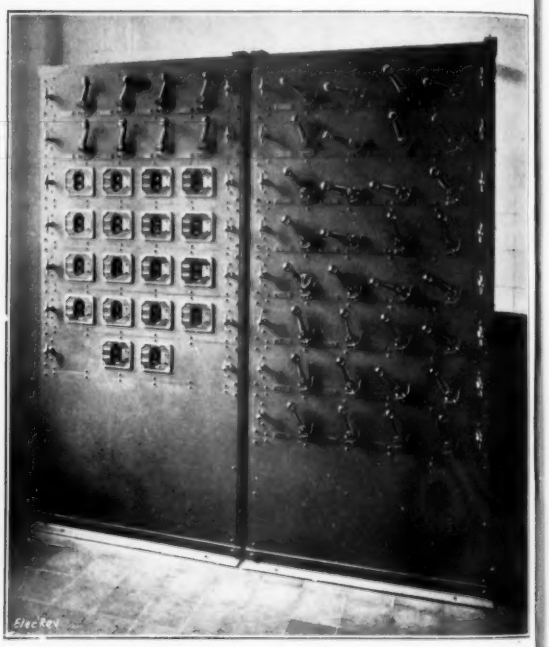


Fig. 10.—Control Panels for Heaters, Fans, &c.

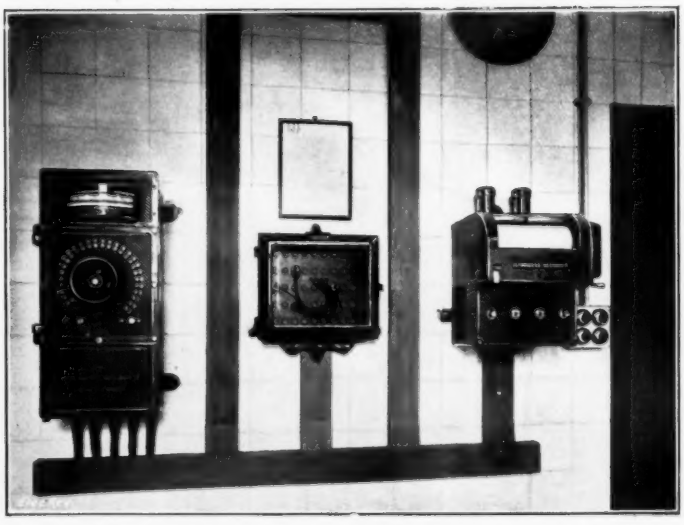


Fig. 11.—Temperature Indicating and Recording Equipment.

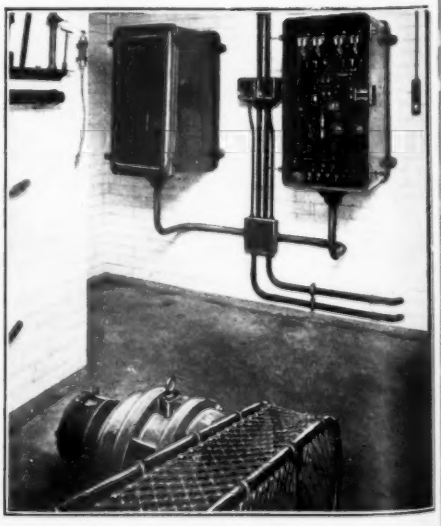


Fig. 12.—Extractor Fan Motor and Control Equipment.

at appropriate places throughout the building and installation, arranged for remote indication and recording in the control room. Fig. 11 shows the indicator instrument on the left, complete with the necessary selector switches, and on the right is the recording instrument. Four records can be taken simultaneously by means of the plug-in selector board shown in the centre. The operation of the plant is so effective, it is claimed, that the temperature of the entire building can be maintained within 1 deg. F. of the desired temperature, in spite of the wide variations in the outside temperature and the number of persons in the building.

In addition to the main ventilation effected by the circulation of air generally throughout the building, there are several motor-driven extractor fans included in the installation, with the necessary air ducts, of course, for drawing off fumes from such places as the kitchens. The motors, 7½ h.p., fig. 12, are also arranged for local and distant control.

From the electricity supply point of view, the installation may be said to be divided into two main sections for supplying the roof and basement equipments, respectively, a separate main switchboard serving for each. Fig. 13 shows the main board for the upper section. It is situated in the control room, and is equipped with 1,500-A 3-pole breakers for the incoming supply and 500-A breakers for the outgoing circuits.

The wiring throughout the installation is v.i.r. cable run in galvanised screwed conduit, and the work was carried out by Messrs. Barlows, Ltd., under the supervision of Mr. J. D. C. McLusky, engineer in charge of the installation. The electricity supply is derived from the Marylebone electricity undertaking.

The motors employed throughout the installation were supplied by Messrs. Crompton, Parkinson, Ltd., and the switchgear and baffle-motor units by the Igranic Electric Co., Ltd. Messrs. George Nobbs, Ltd., manufactured the heaters, while Messrs. G. N. Haden & Sons, Ltd., carried out the erection of the plant. The ammonia compressors were supplied by Messrs. J. E. Hall, Ltd., and the equipment was coated by Messrs. Reid Mcfarlane & Co., Ltd.

In conclusion, we are indebted to Mr. Barker for his assistance in the collection of the above information, and to Messrs. Bourne & Hollingsworth for permission to publish the particulars and photographs.

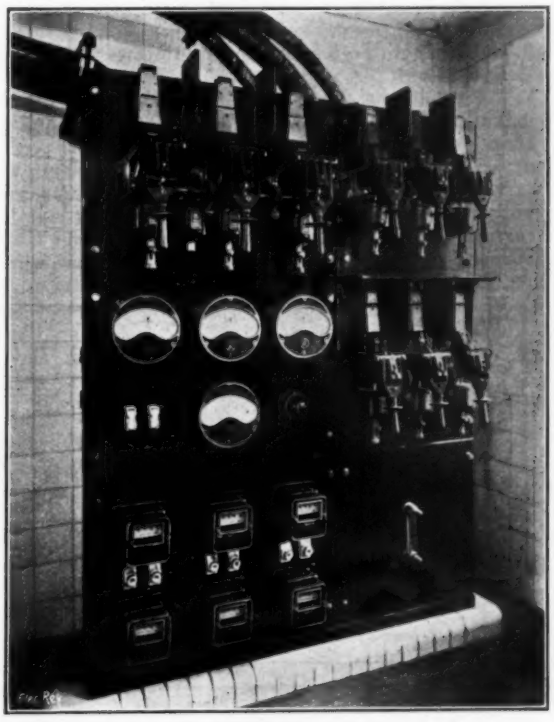


Fig. 13.—Main Switchboard for Roof Equipments.

High-Speed Lifts on Single-Phase Supply.

A descriptive account of a unique two-speed lift equipment, operating on single-phase supply, with a 2:1 speed ratio, built for the G.P.O. by the Keighley Electrical Engineering Co., Ltd.

By R. E. HOPKINS, B.Sc., A.M.I.E.E.

WHILE the operation of two-speed electric lifts on direct-current supply has for a number of years been commonplace lift practice, the application of alternating-current motors to this class of duty has until recently been largely neglected in this country.

The question is to-day receiving much consideration among lift and motor manufacturers—and for a very cogent reason. The increasing height of buildings not only increases the length of travel involved, but also (in virtue of the larger number of landings fed) produces a growing service demand on each lift, and makes high-speed operation essential. To meet this condition some form of two-speed device is necessary if satisfactory stopping conditions are to be secured. Now, this tendency coincides with another, equally pronounced, towards the almost universal adoption of alternating current for all new supplies, and indeed for many of the older direct-current services as well. The production of a satisfactory two-speed a.c. equipment thus becomes daily a matter of more and more importance.

The polyphase problem, although involving many debatable considerations, is inherently simple, and in one form or another is well past its experimental stage. The provision of a satisfactory two-speed drive for a single-phase supply is, however, in a very different category; for, quite apart from any difficulties which may be presented in connection with the method of control, the production of a two-speed single-phase motor satisfactory for lift service has in itself always been the *bête noire* of motor manufacturers, and has therefore set round the lift-maker's neck a mill-stone which practically prohibited excursion into the two-speed, single-phase field.

The lift described in this article has been designed to meet a stringent and definite specification issued by the G.P.O. Engineering Department, involving a dual-controlled lift at 200/100 ft./min. with a capacity of 15 cwt., and for operation on a 440-volt, 40-cycle, single-phase supply. The lift is designed to serve six floors in a busy head post office, and although the necessity for single-phase operation presented known difficulties, it was decided that a reasonably high speed was essential if the lift were to cope adequately with the expected demand. Considerations of floor levelling then made it essential to provide some form of elec-

trical retardation when stopping, if abrupt action and unduly accurate handling of the car-switch were to be avoided.

The contract has been handled throughout by one firm, all the material being designed and built by the Keighley Electrical Engineering Co., Ltd., which company, in addition to possessing extensive lift experience, has for many years been associated with the single-phase motor problem, and so was in a particularly favourable position for dealing with the many considerations involved.

The production of a suitable electric motor for the driving unit was, of course, the first step. A standard single-phase shunt commutator motor, with power-factor compensation (Keighley Cralft motor) was selected as being the most suitable machine for providing at once a high starting torque, low starting current, flat characteristic, and a running power factor approaching unity. As a single-speed unit, the fundamental connections to such a machine are as indicated in fig. 1a.

Advantage was then taken of a property peculiar to this motor, whereby it is possible to raise the speed above synchronism by the injection into the brushes YY of a small pressure provided by a speed-controlling transformer of standard construction. The appropriate connections are indicated in fig. 1b. By a fortunate circumstance it is seen that the same pressure can be used to provide the quadrature component necessary for power-factor correction, so making it possible to avoid the necessity for two separate transformer units.

The synchronous speed of the motor used was 800 r.p.m., and when operating under condition 1b, this was raised to 1,000 r.p.m., the sheave and worm gear being then designed to hoist at 200 ft./min.

The next step in the problem was the designing of an inversion to the connections, whereby the speed, instead of being raised to 1,000 r.p.m., would be depressed to 500 r.p.m. and so provide the desired landing speed of 100 ft./min. In theory this merely involved a displacement in the phase angle of the injected rotor pressure through 180 degrees (electrical).

For certain technical reasons, however, such an arrangement would seriously disturb the desirable shape of speed characteristic inherent to the shunt-commutator motor, and this fact made it necessary to introduce a slight complication in the switching and to impose pressure on the brushes XX as well as the brushes YY. The manner in which this was arranged is indicated in fig. 1c, and it is seen that the XX and YY brushes are under this condition linked together instead of remaining separate. In this manner a flat compensated characteristic was obtained just as with the high-speed operation. Figs. 1d, 1e, and 1f represent conditions corresponding with 1a, 1b, and 1c, respectively, but for the opposite direction of rotation.

In a complete journey, the full motor cycle is therefore as follows:—

(1) Under connection 1a the machine develops a powerful starting torque and accelerates to 800 r.p.m. as a normal single-speed Cralft motor, the brush circuit XX being closed when acceleration is complete. This connection is obtained on the first step of the car switch.

(2) Under connection 1b the machine accelerates to 1,000 r.p.m., the transformer providing both the desired hyper-synchronous speed and the high power-factor necessary to a low current consumption. This connection is obtained on the second step of the car switch, and provides the normal operation at 200 ft./min. which obtains for the full-speed portion of the travel.

(3) Under connection 1c the motor decelerates to 500 r.p.m., the same transformer being employed for the purpose, but with its connections arranged to reverse the sign of the impressed rotor voltage. This connection is obtained on returning to the first step of the car-switch, and is preliminary to stopping when the desired landing is approached.

The motor connections defined above were selected as being those most appropriate to the problem in hand, and without reference to the complication of the automatic controller, which would be able to realise them. The controller problem proved to be perhaps more

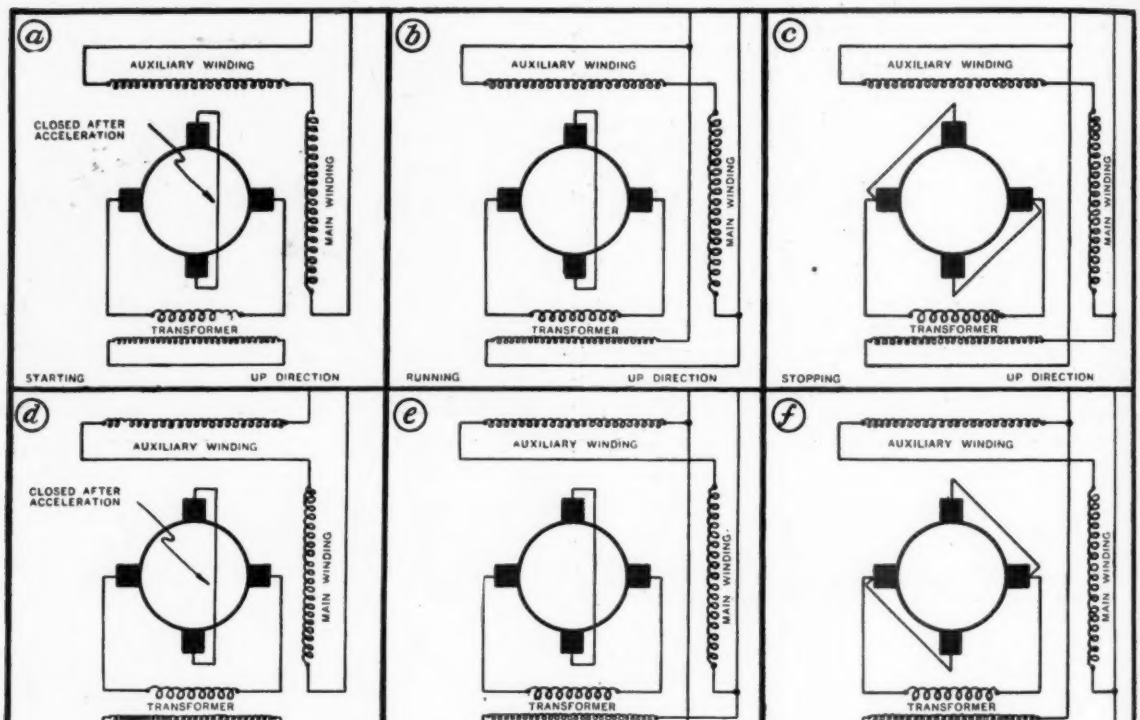
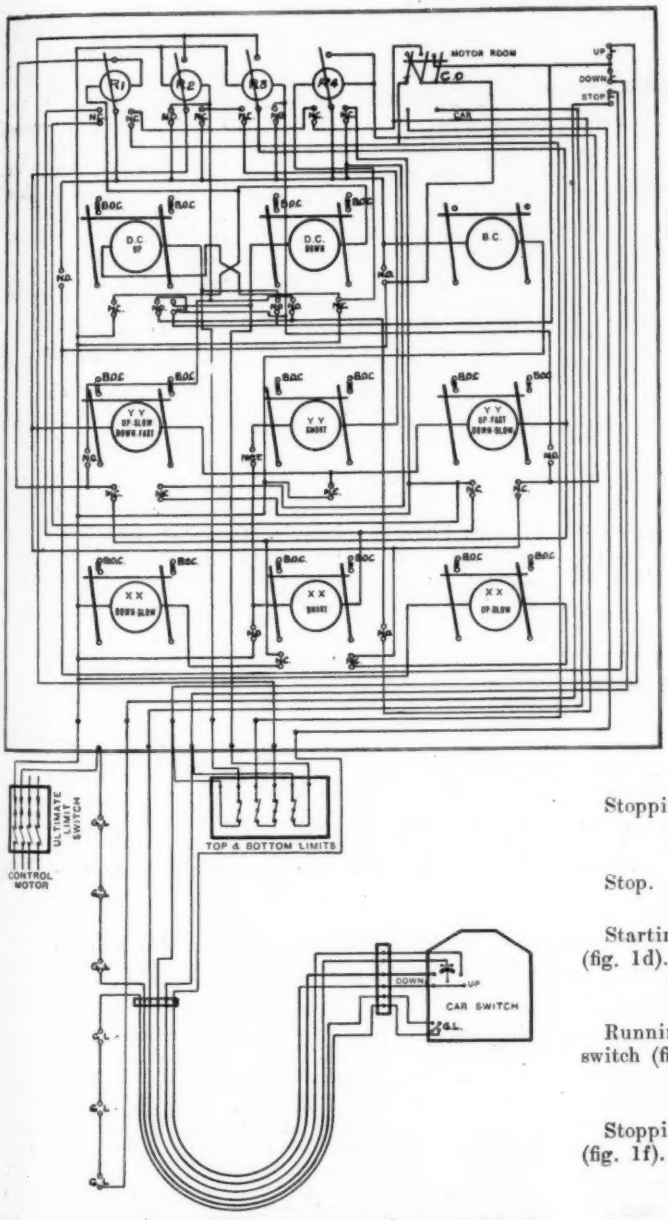


Fig. 1.—Fundamental Connections of 2-speed, Single-phase Motor.

difficult than that of the motor itself, but here, again, the fact that the Keighley Company manufactures its own switchgear proved of tremendous assistance, and enabled a controller to be produced which, though complicated in its wiring, involved nothing but standard double-pole contactors and the usual relay contacts in its construction.

The chief difficulty was the necessity for a comparatively complicated switching sequence (in which many of the contactors operated in more than one capacity), coupled with the necessity for an absolutely complete interlocking system. The latter had to ensure that by no abuse of the car-switch, the control change-over switch, or the motor-room push-buttons, would it be possible to cause anything worse than an unusually heavy current surge, and that by no juggling with the handle could the contactors be made to close in any but the correct sequence.



DC, direction contactor; BC, brake contactor; YY, transformer contactor; XX, rotor contactor; R1—R4, sequence relays; BOC, blow-out coils; NC, normally closed interlock; NOT, normally open time-lagged actuating contacts; NO, normally open actuating contacts; GL, gate locks; CO, control changer switch.

Fig. 2.—Diagram of Control Connections for Keighley Car-switch Lift, using 2-speed, 1-phase "Cralft" Equipment.

The practical working-out of the connections required as above involved the use of nine d.p. main contactors, which were allocated to the following duties, and are shown in fig. 2, but with the main connections omitted to simplify the diagram as far as possible for clearness.

Contactor A (marked D.C. UP), connecting the main stator winding for clockwise rotation.

Contactor B (marked D.C. DOWN), connecting the main stator winding for counter-clockwise rotation.

Contactor C (marked B.C.), connecting to the coil of the electro-mechanical brake solenoid.

Contactor D (marked YY UP-SLOW, DOWN-FAST), connecting the primary of the speed-controlling transformer in one direction.

Contactor E (marked YY SHORT), short-circuiting the primary of the speed-controlling transformer.

Contactor F (marked YY UP-FAST, DOWN-SLOW), connecting the primary of the speed-controlling transformer in the opposite direction.

Contactor G (marked XX DOWN-SLOW), linking the XX and YY brushes in one direction.

Contactor H (marked XX SHORT), shorting the XX brushes together.

Contactor I (marked XX UP-SLOW), linking the XX and YY brushes in the opposite direction.

It will be noticed that the contactors are never called upon to handle the low-voltage heavy currents peculiar to the YY brushes, and that all this switching is carried out on the primary side of the transformer, where the currents involved are reduced to approximately one-tenth of those on the secondary side. The sequence and grouping in which the above contactors close had then to be made such as to realise the connections shown in the various parts of fig. 1, namely:—

Starting (UP). First UP notch of car switch (fig. 1a).
Close A, C, E.
Close H (through a time lag).

Running (UP). Second UP notch of car switch (fig. 1b).
Open E.
Close F.

Stopping (UP). First UP notch of car switch (fig. 1c).
Open F, H.
Close D, J.

Stop. Zero position of car switch.
All contactors open.

Starting (DOWN), first DOWN notch of car switch (fig. 1d).
Close B, C, E.
Close H through time lag.

Running (DOWN), second DOWN notch of car switch (fig. 1e).
Open E.
Close D.

Stopping (DOWN), first DOWN notch of car switch (fig. 1f).
Open D, H.
Close F, G.

Stop. Zero position of car switch.
All contactors open.

Remembering the necessity for a complete interlocking system, and noting that the same first notch of the car switch has to cause a contactor grouping that is entirely different when stopping from that when starting, it is evident that no little complication of wiring must be involved for the control circuits. The manner in which it was done is indicated in fig. 2, which is a duplicate of the actual wiring diagram to which the electrical components were wired.

There are in all, in addition to the nine main contactors, four sequence relays (at the top left-hand corner) and twenty-eight actuating and interlocking contacts. Many of these could have been omitted had it been possible to assume thoughtful driving on the part of the car-switch attendant. In practice, however, this assumption can never safely be made. The car switch is necessarily remote from the machinery which it controls, and unless the sequence is adequately interlocked on the controller, an attendant can wreak considerable havoc in the motor room without being aware of anything more than a slightly eccentric behaviour of the lift car.

The controller was therefore provided with the fullest interlocking system, so that in no circumstances could the switching sequence be disturbed by thoughtless handling of the car switch.

The driving unit, automatic controller, and speed-controlling transformer are all illustrated in fig. 3, the remaining portions of the electrical and mechanical equipment being on normal lines.

On its tests the equipment was found to operate with considerable success. The efficiency and power factor of the motor on full load were found to be 84 per cent. and 0.91, respectively, while the starting consumption was 44 kVA, when developing a maximum of four times full-load torque (equivalent to 60 h.p.). This, of course, represents a performance superior in all respects to that possible even with a single-speed polyphase motor, and amply demonstrates the utility of such an arrangement for general use.

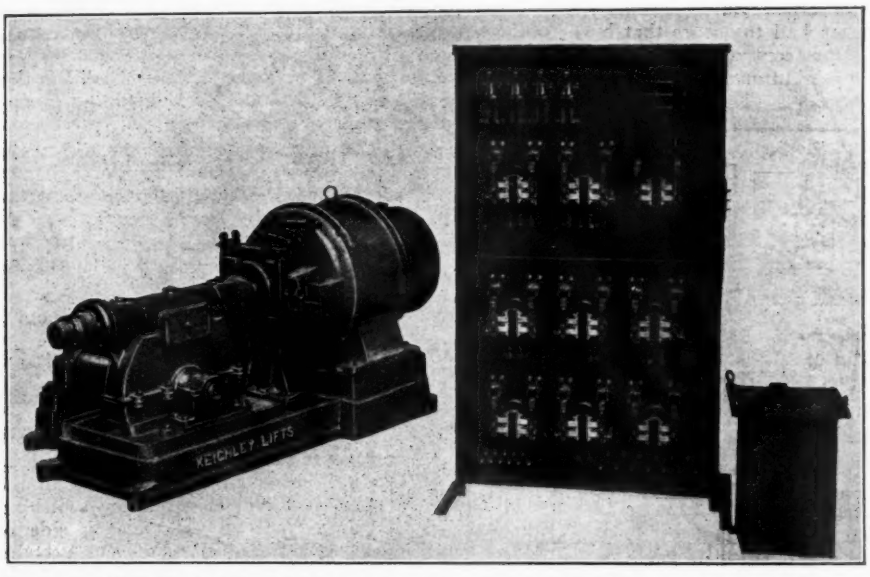


Fig. 3.—Winding Unit and Control Panel for 2-speed, Single-phase Lift Installation.

The equipment is believed to be at the moment unique, and to represent the first practical exploration of the full properties of the shunt-commutator machine. Its interest, hitherto academic, therefore now becomes a matter of much more practical politics, and indeed sets single-phase working on a par with any other supply system for high-speed lift work.

Rateable Value and Multi-Part Tariffs.

The author discusses whether a "fixed" charge based on the assessment to rates should vary with that figure or remain stationary in spite of variations.

By W. ERIC JACKSON, LL.B., Barrister-at-Law.

LEGISLATION is often far more extensive in its effects than legislators anticipate. There is nearly always some unforeseen circumstance which makes the effect of a law somewhat different from what was intended. And this is borne out to some extent in the electrical world by the results which it is quite possible that the new rating legislation may have upon the rates and prices for electricity supplied.

There are all over the country suppliers who base their rates not only upon the amount of electricity consumed, but also upon some other basis, making a fixed charge at the outset to each consumer, and then charging him in addition for the quantity of energy indicated by his meter. Such "multi-part" tariffs are by now quite well established, although they were not foreseen in the original Electricity Acts. Up to 1926 there was no specific mention of such tariffs. The Act of 1899 (Section 31 of the Schedule) provided that suppliers should be able to charge for "energy consumed." The mode of charge was provided by the Act—being calculated either on electrical quantity or some other basis approved by the appropriate Minister. No provision was made, however, for the charging of the consumer with the cost of overhead charges or establishment costs, as it is intended to do by the multi-part tariff. Section 33 of the Act, however, allowed suppliers to make any agreement with their consumers as to the mode of charging. Further, the Act of 1922 repealed Section 31 (Sub-section 2) of the Schedule to the 1899 Act, and empowered the Ministry of Transport to alter or prescribe methods of charging, thus definitely abolishing the consumer's right to insist on being charged a flat rate for energy.

The fact remains that the practice has grown up of making these multi-part tariffs, and it is evident that they serve a very useful purpose. By the Act of 1926 multi-part tariffs are sanctioned by law expressly. Section 42 says that suppliers may make a periodical fixed or service charge, and in addition a charge for energy supplied. The method of charge must be authorised either by Special Order or some other method.

Apparently the Ministry of Transport or the Electricity Commissioners have not yet made any regulations showing how such a fixed charge is to be made up. For the moment then, the only type of fixed charge that we can consider is that made under private agreement with the consumers. The methods vary: some charge on the basis of the number of lamps or points fitted to the consumer's premises, others on floor area, and others, and this is the most important, on rateable value.

Now, as everyone knows, the rating surveyors are at this very moment engaged on re-valuing all properties of an industrial nature all over the country for the purpose of the new assessments which are to come into force as part and parcel of the pending local government legislation. The question will have to be faced by both suppliers and consumers whether the increase or diminution of the rating assessment will also affect the fixed or service charge for electricity. A principle will have to be sought that will apply to all equally; for in some instances the rateable value will go down, and in others there may be an increase. The question has very properly been asked whether if the rateable value goes up the supplier will be able to claim a proportionate increase in his fixed charge, and whether the consumer will get relief if the rateable value goes down.

At the outset, there appears to be veiled behind this question a slight misunderstanding of the nature of the changes that are now taking place. Strictly there is no re-valuation, although in the consideration of each case the surveyors will no doubt adjust the rateable value where necessary, if it appears to be too low or too high. But the purpose and provisions of the Rating and Valuation (Apportionment) Act are, as its name shows, not to re-value property, but to divide the existing valuation into the part applicable to industrial uses and the part utilised for other purposes, to make it possible to ascertain the proper extent of relief.

The assessment will stand as at present, but instead of a workshop and showroom being included in one assessment at, say, £1,000, that £1,000 will be split up into, say, £600 for the workshop and £400 for the showroom. And the occupier of those premises will get rate relief for the £600 representing the workshop, but will have to pay full rates on the £400 for the showroom.

Accordingly, in a sense, the new valuation, as it is called, will cause in the case of industrial heredita ments, a substantial reduction in the rates to be paid. For the most part the new rating laws will not affect the actual rateable values. But the amount of the assessment to rates will alter.

Now there are numerous cases apart from this occurring in each year, in which the rateable value increases or decreases, and the valuation is correspondingly adjusted. The question thereupon arises whether such an adjustment of the rateable value will result in a corresponding adjustment of the fixed charge, where this is based on the rateable value. The only answer to this question is that it all depends on the terms of the contract between the supplier and the consumer. Generally, the fixed charge ought to vary in the same way as the water rate does, when the rateable value fluctuates. If the contract states that the fixed charge shall be so much per cent., or so much in the pound of the rateable value, then the charge will rightly vary in each year according to the alterations in the rateable value. But where the contract says that a fixed charge of £*x* is made, and this is explained as having been arrived at by taking a percentage of the rateable value, then the fixed charge should not vary until a fresh contract is made. In the latter case the use of the rateable value does not form part of the contract, and the mention of it in the agreement is only by way of explanation.

Individual consumers and suppliers can therefore examine their own agreements in the light of this principle. Beyond this no more can be said. The presumption would generally be that the rateable value formed part of the contract, and that the charge would vary, or rather the basis of the charge would vary, the supplier making an alteration in his rates in the same way as the local authorities did when the assessments were raised wholesale a year or two ago. Obviously if the rateable value of an area increases by the raising of the assessments, and not by any enlargement of the district, then the supplier ought not to keep his rate the same, for his production costs do not vary in proportion with the rateable value of the area. Unless suppliers do make some adjustment in this way, the use of the rateable value as a basis for charge becomes absurd. Its use in any event is open to the objection that it does not follow that a man who lives in an expensive house uses more electricity proportionately than a man who lives in an establishment of more moderate size. But this same objection may be used against almost every other method of basing the fixed charge. The area of the floors or the number of lamps fitted do not of themselves give a sure indication of the consumption. But the use of rateable value as a mode of assessing the fixed charge is obviously convenient as it enables the supplier to know at once, by obtaining the total rateable value from the local authority, the potential value of his area, while at the same time the rateable value of each set of premises in the area gives him a definite indication of the quality and relationship of each property with every other property in the area. It saves him the trouble of measuring floors or ascertaining the basis of any other usual mode of assessing the fixed charge.

But the supplier should remember that if he uses rateable value, his moral duty is the same as that of the local authorities and the water companies. He should take his expenditure and divide it out according to the rateable value; not assess each property with an electricity rate and then spend accordingly. If the rateable value of each property in the area is doubled, then the fixed charge ought to be reduced by half, just as the local rates should be. Unless this is done the use of rateable value as a mode of fixing the service charge is open to abuse.

Low-temperature Electric Heating.

Mr. Geo. Wilkinson, M.I.E.E., in a paper before the Institution of Heating and Ventilating Engineers, described the application of electricity for heating purposes by means of his "change-circuit" apparatus, which increased the load factor of electricity supply stations, and so made domestic electric heating a possibility on cost alone. After dealing with cost of supply and practical economies, Mr. Wilkinson said that from Government returns, and assuming an increase in load factor of from 25 per cent. to 75 per cent., it was clear that during the year 1927-8 there was available for heating purposes the enormous total of 19,855,701,260 kWh at 1/3d. per unit. Electrical energy had the enormous advantage that it could be readily delivered at any point where heat was required, also the expense of pipe transmission and heavy heat losses of transmission were saved. Each floor, and, if necessary, each radiator or panel might have its separate storage cylinder which would absorb the constantly varying amount of energy received from the "change-circuits," thus forming a heat reserve to be drawn upon at such times and rates as required to maintain uniform temperature under all weather variations. The absence of combustion and the products of combustion enabled these cylinders to be placed in positions where any radiation loss was usefully employed.

A Very-Low-Pressure Turbo-Generator.

Some particulars of the steam turbo-generator set designed for use in connection with the Claude-Boucherot water-temperature-difference scheme.

WE give herewith some illustrations and brief particulars of an interesting low-pressure steam turbo-generator set, fig. 1, recently completed by the Société Alsacienne de Constructions Mécaniques, of Belfort, France, for the experimental plant which has been established on the banks of the River Meuse, in Belgium, by the Société d'Ougrée-Marihaye, to try out the system developed by Messrs. Georges Claude and Boucherot to utilise the difference of temperature between the water at the surface and that at the bottom of tropical seas.

The turbine is of an entirely new type, and was designed to meet the requirements laid down by Messrs. Claude and Boucherot, which included the following:—

Load	50 kW.
Steam admission pressure ...	0.0323 kg. (abs.) per sq. cm.
Admission temperature of steam	25 deg. C.
Exhaust steam pressure	0.0125 kg. (abs.) per sq. cm.
Exhaust steam temperature ...	11.5 deg. C.

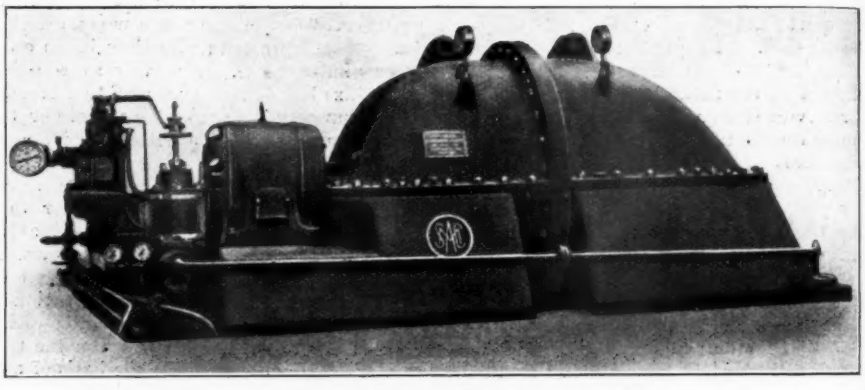


Fig. 1.—50-kW Low-pressure Turbo-generator.

The turbine and generator are supported by means of large feet cast with the admission and exhaust port bodies on two longitudinal members located one on each side of the centre line. The dynamo, which is of the company's standard high-speed d.c. type, is of the bipolar pattern, and has an output of 228 A at 220 V, at a speed of 6,000 r.p.m. It is mounted on the admission side of the turbine casing, and is directly connected to the turbine shaft. To the left of the dynamo is the turbine regulator, this position for the latter having been found more convenient than between the turbine and dynamo. The components of the set are therefore in the following order: (1) Bearing supporting the regulator and the oil pump; (2) the dynamo; (3) an intermediate bearing between generator and turbine; and (4) a bearing on the exhaust side of the turbine. A further advantage of the arrangement is that the steam admission and exhaust pipes are located in the centre line of the set, and so have not only a minimum of elbow turns, but a shape best suited to prevent giving rise to local compression zones and eddies, which are always the cause of losses.

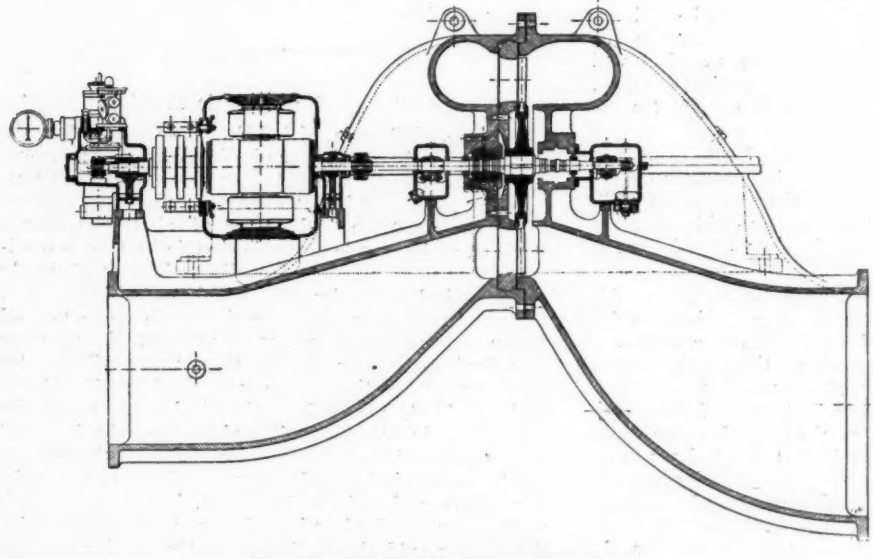


Fig. 2.—Section Through Turbo Set.

The turbine is of the single-stage type, with an average diameter of 2 ft. 7½ in. The special arrangement of the steam admission and exhaust, as shown in fig. 2, results from the necessity of providing very wide passages in order to avoid any load losses in the piping.

The shaft bearing on the exhaust side works in a vacuum, rendering any steam-tight packing at this point unnecessary. It is furnished with an independent circulation of oil maintained by a special gear pump driven by a spiral gear wheel and a worm keyed on the

turbine shaft, the oil being contained in a small reservoir with a cooling coil formed with the bearing itself.

The steam-tight joint on the admission side, where the shaft passes through the casing, comprises a disk keyed on the shaft and rotating in a circular, vertical recess formed in the turbine casing. A water injector at this point maintains a liquid ring along the periphery of the disk, the ring being maintained in position by centrifugal action, and so forming a hydraulic joint.

The speed of the turbine is controlled by a special regulator made in accordance with a Claude-Boucherot patent which operates by the addition of air to the exhaust steam. A small oil-pressure servo-motor actuates an adjustable valve, the profile of which is such that the steam supply and its corresponding output are proportionate to the stroke of the valve. The control gear comprises the usual components fitted to turbo sets by the Société Alsacienne. In order, however, to obviate the interpolation of valves in the admission piping such as are used in high-pressure turbines, but which in this case might give rise to serious losses, the speed is controlled, as already briefly mentioned, by acting on the exhaust steam, by admitting air between the exhaust piping and the condenser. A safety device located on the regulator cover acts by oil relays on a variable air inlet valve and simultaneously on a safety valve provided in the exhaust. The opening of the adjustable device and the safety valve causes an admission of air sufficient to break the vacuum. In addition, in order to adjust the power of the turbine to the load, means are provided to vary the quantity of water admitted to the boiler and to the condenser.

The turbine wheel, fig. 3, and its blades are of the Company's usual contruction. The distributor is of

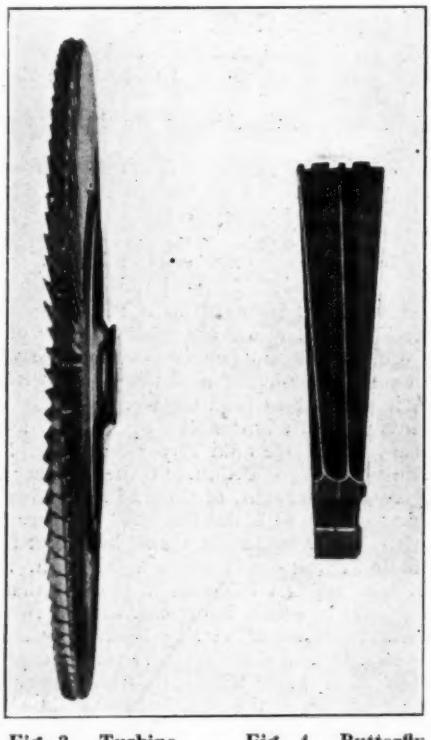


Fig. 3.—Turbine Wheel.

Fig. 4.—Butterfly Blades.

cast-iron, while the blades are of non-rusting metal. Adjustable blades, to give a variable angle for the steam inlet, are provided, these being of non-rusting chrome heat-treated steel and of a special "butterfly" type (fig. 4). It is to these blades that the closeness of the actual results to the theoretical estimates referred to below is attributed, the shape, it is claimed, enabling the steam to expand to the maximum degree in blades of great length in relation to their average work.

The first tests of the new set were carried out in May last. The results given in the appended table are, however, those of tests conducted in June, when the general temperature of the River Meuse was much higher, 19 deg. C., so that the relation between theo-

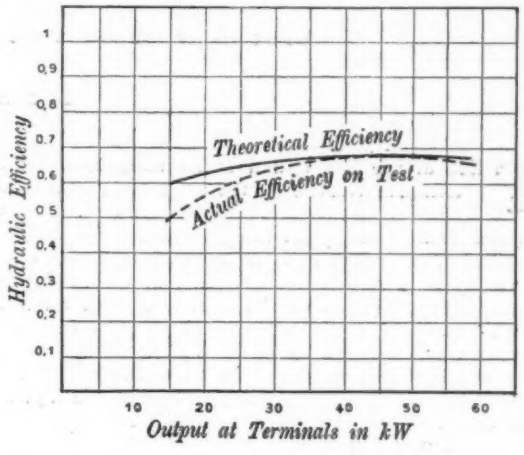


Fig. 5.—Theoretical and Actual Efficiency Curves.

retical and actual results is not so close as in the May tests, despite which, however, they are regarded as interesting and satisfactory.

COMPARISON OF THEORETICAL AND ACTUAL RESULTS.

	Theoretical.	Actual.
Output	50 kW	54.9 kW
Turbine speed, r.p.m. ...	6,000	5,500
Steam admission temperature	25° C.	35.8° C.
Admission steam pressure, kg./cm.²	0.0323	0.06
Exhaust steam temperature	11.5° C.	28° C.
Exhaust steam pressure, kg./cm.²	0.0125	0.0387
Total adiabatic fall in calories	23	13.9
Steam supply per hour in kg.	3,170	6,110
Ratio of steam speed to tangential speed ...	1.75	1.46
Hydraulic efficiency ...	74.5%	68.2%

With regard to the last item of the table, the theoretical hydraulic efficiency based on the actual conditions of the test is 67.1 per cent., so that the results, which are shown diagrammatically in fig. 5, were even better than expected.

Dangerous Occurrences Notification Order.

The Home Office has announced extension of the provisions of the Act requiring notice of accidents in factories and workshops to be given to an inspector, to the following classes of occurrences: I. bursting of a revolving vessel, wheel, grindstone or grinding wheel moved by mechanical power; II. breaking of a rope, chain, or other appliance used in raising or lowering persons or goods by aid of mechanical power; III. explosion or fire causing damage to the structure of any room or place in which persons are employed, or to any machine or plant contained therein, and resulting in the complete suspension of ordinary work in such room or place or stoppage of machinery or plant for not less than five hours, where such explosion or fire is due to (i) the ignition of dust, gas or vapour, or (ii) the ignition of celluloid or substances composed wholly or in part of celluloid, or (iii) electrical short circuit, or failure of electrical apparatus; IV. explosion or fire not included in paragraph III affecting any room in which persons are employed and causing complete suspension of ordinary work therein for not less than 24 hours.

Boiler-House Operation.

Some Notes for the Assistance of the Combustion Engineer.

By S. ANDERSON.

THIS article is not, and is not intended to be, a technical treatise on the subjects of coal combustion and steam raising. Indeed, such a treatise dealing with plant composition and layout, the choosing of suitable coals by analysis and by boiler test, the analysis of flue gases, &c., and also boiler-house management could not be contained in a large volume. These notes are as non-technical as possible, and are written as an attempt to help the power-station plant operating engineer to a better understanding of the factors he himself can control, and thus enable him to operate the boiler-house at the highest efficiency and therefore lowest cost.

On one occasion the writer had to prepare a comparison of a number of coals tested in a boiler. As the comparison was required by the management only, and not by the engineer, the summary submitted consisted of two items for each coal:—

(1) The price of the amount of coal required to evaporate 10,000 lb. water as from and at 212 deg. F.

(2) The percentage of ash as found from the test.

The importance of the second item is apparent when one realises that ash has to be paid for, in bringing it to the works, in handling at the works, and in most cases in disposing of it. Now if, in the first item, we substitute for the price of the amount of coal the weight of coal required, we have, in these two, the main points for the consideration of the operating engineer. His job therefore is—

(1) to keep the amount of coal required, for a certain heat transference to the steam, at a minimum, and

(2) while he has, of course, no control over the amount of ash brought to the works, he can control the amount in excess of that which is treated in the works as ash, and disposed of as such; at the same time, he ensures that the amount of unburned fuel present in the ash and carried away in the ash is kept at a minimum.

Having thus stated the main points of his job, we will examine the methods he will employ to obtain the desired results.

It is, I think, essential, in the first instance, that the engineer should know something about the working-out of a "heat balance" for the individual boiler in order that he may more fully understand the profit and loss account. For this reason, then, the following typical example is submitted. This was taken on a boiler and economiser fitted with travelling-grate balanced-draught stokers. All details superfluous to the calculations have been omitted.

Data: Coal, c.v. gross as fired, 11,136 B.th.u. Ultimate analysis, carbon 61 per cent., ash 12.65 per cent., moisture 12 per cent., sulphur 1.35 per cent., hydrogen 4.5 per cent., oxygen and nitrogen (balance) 8.5 per cent.

Evaporation: per lb. coal (actual) 7.168 lb. Steam pressure 208 lb. abs., and temperature 635 deg. F., giving a heat content from feed temp. (102 deg. F.) of 1,274.4 B.th.u.

Ash (dry): 13.24 per cent., combustible in ash 10.6 per cent. Flue gases at economiser outlet, temperature 335 deg. F., CO_2 11.9 per cent. O_2 8.07 per cent. CO nil. Nitrogen (by balance) 80.03 per cent.

Boiler-house *air temperature, 62 deg. F.*

The heat balance is obtained thus:—

Heat input to steam $= 7.168 \times 1,274.4$.
$= 9,135$ B.t.hu.

Heat lost in unburned carbon in ash $= .1324 \times .106 \times 14,600$ (% dry ash × % carbon in ash × c.v. of carbon) $= 205$ B.th.u.

Heat lost to chimney is found by the sum of the following two:—

(1) Heat carried away by dry flue gases per lb. coal. Now, the weight of dry flue gases per lb. carbon

$= (44 \times \%CO_2) + (32 \times \%O_2) + (28 \times \%N_2)/12 \times \%CO_2$

(the flue gas analysis being by volume in the above these volumes are multiplied by the atomic weights of the respective stuffs)

$= (44 \times 11.9) + (32 \times 8.07) + (28 \times 80.03)/12 \times 11.9$

$= 21.2$ lb. Therefore the weight of dry flue gases per lb. coal $= 21.2 \times .61 = 12.93$ lb.

Taking the specific heat of these gases at 0.24, and multiplying by the temperature rise, we have the heat loss per lb. of coal in dry flue gases

$= 0.24 \times [12.93 \times (335 - 62)]$
$= 845$ B.th.u.

(2) The heat loss to chimney due to moisture consists of the weight of moisture multiplied by the total heat (sensible, latent, and superheat) given to the water

$= [0.12 + (9 \times .045)] \times [(212 - 62) + 970.4 + .49(335 - 212)] = 620$ B.th.u.

(The hydrogen is multiplied by 9 as hydrogen unites with eight parts of oxygen and makes nine times its weight in water.)

The total losses to the chimney are then $845 + 620 = 1,465$ B.th.u.

Our heat balance is now capable of statement, and is:

Heat input to steam	= 9,135 B.th.u.	= 82.03%.
Heat lost to chimney	= 1,465 B.th.u.	= 13.16%.
Heat lost in ash	= 205 B.th.u.	= 1.84%.
Radiation loss (balance)	= 331 B.th.u.	= 2.97%.
Total ...	= 11,136 B.th.u.	= 100%.

This heat balance is useful, as it not only shows us the boiler losses, but also shows what the effect of varying the different factors contributing to these will be. For instance, on the question of additional wetting of the coal, it will be seen from the foregoing calculations that in this case an addition of 5 per cent. of moisture to the coal (making the total 17 per cent.) would result in an addition of 59 B.th.u. to the chimney losses. This represents ½ per cent. of the total heat value of the coal and, together with the fact that moisture in the coal tends to smoke formation, makes it evident that indiscriminate wetting should not be indulged in. It has, however, been amply established in practice that when a large amount of smalls is present, as in a rough unwashed slack, additional wetting is often necessary to ensure even fires, and therefore more perfect conditions. This addition of water will, of course, vary with the class and condition of the coal, but should at all times be kept at a minimum. The loss due to unburnt carbon in the ash is important, due to the high c.v. of the carbon. This loss, more often than not, is quite serious, especially when high percentages of CO_2 are striven for, and every effort should be made to keep this as low as the figure in the example (*i.e.*, 1.84 per cent. of the c.v. of the coal). This, of course, refers to travelling-grate equipment—where pulverised coal is used, owing to the minuteness of the coal particles and the consequent ease of mixing with the necessary air for combustion, this loss should not be greater than one half of one per cent.

That the chimney losses—the biggest and therefore

the most important—will vary with the percentage CO_2 in the gases, and the temperature of these gases at the chimney, is also apparent from the calculations.

The maximum CO_2 which can be obtained, if perfect combustion conditions prevail, will depend upon the carbon content of the fuel and, in the average bituminous coal such as in the example, this will vary between 17.5 per cent. and about 19 per cent. These figures are impossible of attainment in practice, the limiting factors being:—

(1) The damage which would result, due to excessive heating, to the stoker equipment and furnace linings.

(2) In all but a very few cases, the inadequate size of the combustion chamber.

(3) The difficulty of air distribution to ensure the correct amount being available at the different stages of combustion.

Modern stokers equipped with balanced draught and furnace refractories should be capable of standing up to the conditions prevailing with 15 per cent. CO_2 present.

In, however, none but the most modern of boilers is the combustion chamber of sufficient size to ensure, with this diminished air supply, the thorough mixture and perfect combustion of the gases. Smoking at the stack is the visible sign of this limitation, which with even the best of balanced-draught equipment necessitates the percentage of CO_2 being kept in the region of 13 per cent. or at the most 14 per cent. Summarising, then, the nearest to perfect combustion conditions will be obtained when the per cent. CO_2 is kept as high as is possible consistent with a clear stack, no CO is present in the flue gases, and the minimum of unburnt carbon is present in the ash. Under these conditions and with a constant feed temperature and boiler loading, the temperature of the exit gases will be an indication of the cleanliness or otherwise of the boiler and economiser.

Leaving now the question of combustion conditions and turning to the transference of the heat to the steam, it will be obvious that if all other conditions remain constant and the water inlet temperature to the economiser is raised, the outlet gas temperature from the economiser will also increase. This will of necessity result in a decrease in the boiler and economiser efficiency, and appears to be an unanswerable argument in favour of cold feed. This is only true where no means of feed heating is available other than by high-pressure steam. The temperature of the feed in this case should be kept as low as possible provided that it does not drop below the dew-point of the gases. This is the point at which there will be condensation of these and the formation in this way of sulphuric acid from the sulphur dioxide present will set up active corrosion of the economiser tubes.

Where, however, hot feed is available, from either heaters where the steam is bled from the main turbines (the best source) or from modern steam-driven auxiliaries, where the whole of the heat in the exhaust steam is recoverable in the feed water, it will certainly pay to feed with water as hot as the feed pumps will deal with. The more the heat units that are added to the feed water before entering the economiser, the less will be the required heat transference in the boiler plant and thus the amount of steam generated per pound of coal will be increased. Again, if the economiser be of a suitable size, the exit gas temperature will not increase by the same amount as the increase in feed inlet temperature. The following figures are the result of six carefully carried out tests of a B. & W. boiler of 9,273 sq. ft. heating surface, with 2,728 sq. ft. superheater heating surface and 4,752 sq. ft. economiser heating surface.

(1) With feed inlet temperature of 96 deg. F., evaporation per lb. of coal (actual) = 8.182 lb., steam temperature = 597 deg. F. and efficiency = 83.4 per cent.

(2) With feed inlet temperature of 152 deg. F., evaporation per lb. of coal (actual) = 8.617 lb. of steam temperature = 582 deg. F. and efficiency = 81.3 per cent.

Thus with a loss of only 15 deg. F. in the final steam temperature the evaporation was increased about 5 per cent. Again, although there is a loss in actual boiler efficiency of 2.1 per cent., it is of interest to note that if the boiler in the "hot-feed" case is credited with the feed temperature of the "cold-feed" case, the efficiency of the former (hot-feed) works out at 85.2 per cent. This is equivalent to assuming that the extra heat units (152-96) in the hot-feed have been given without any cost whatever. Where these heat units are given by steam bled from the main turbines, the saving of coal in this case works out to a figure of about 4 per cent. Of course, where the heat units added are obtained from the exhaust of auxiliaries, the saving will not be so great, and will depend on the type of auxiliary used; but none the less it is clear that there will be a saving.

Considering next the operation of the boiler house as a whole, where the efficiencies are the same, those boilers with the highest superheat should be steamed in preference, wherever possible. This is mainly due to the beneficial effect of the superheat on the consumption of the turbines. In connection with this superheat question the following proposal deserves serious consideration. It is applicable to the land type of B. & W. boiler, and is that some thirty or forty boiler tubes be removed from the bottom rows. These tubes would be removed in groups of six (say), each group consisting of three on the bottom row, the two above these in the second row, and the one above these in the third row. This would leave a staggered and larger heating surface exposed to the radiant heat from the fuel bed. The removal of these tubes will not, I think, reduce much the effective heating surface of the boiler, and will give a greatly increased final steam temperature. If the economiser be of sufficient size, there should be no appreciable rise in outlet gas temperature, and therefore little drop in overall efficiency. This efficiency should further be maintained by the increased combustion chamber rendering it possible to maintain a larger percentage of CO_2 than before. The proposal is, at the least, deserving of consideration where this type of boiler exists.

The next important point is that the regulation necessary for a varying steam demand should be carried out in the minimum of units and wherever possible on one boiler alone. This allows the others to be set as carefully as when on test and at their most efficient loading. This regulating boiler should be the one with the most flexible of draught systems so that the losses due to excess air may be kept at a minimum. Automatic boiler control will, of course, be the solution of the regulating problem, but a great deal can be done where manual control is in use by careful supervision.

The light-load period is, naturally, the worst as far as boiler-house efficiency is concerned, and the system known as "live-banking" has much to recommend it in this respect. Briefly this is, at light loads no boilers, which will be needed again in, say, up to eight hours' time, should be taken off the range and banked; instead they should be kept steaming at the lowest possible rate without the induced-draught fan. In modern boilers with balanced-draught stokers the boiler efficiency at fractional loads can be kept at a remarkably high level. On this type of boiler the CO_2 has been maintained as high as 11 per cent. or even 12 per cent. at one-fifth of the normal rating for hours on end, with no detrimental results whatever.

The boiler-house efficiency over the week is certainly improved with this system; the only drawback is that the temperature of the steam as delivered to the engine room is constantly lowered. Where, however, a high steam temperature is not so important (admittedly in few cases), a surprising gain may be effected by "live banking."

In the generating station the use of the "Parsons line" is helpful where an intelligent check is required on boiler-house performance. This line is, of course, obtained by plotting the total units generated on each shift against the total coal (in lb.) consumed over the same period. The straight line thus obtained is produced until it cuts the "total coal" ordinate. At this point the standing or basic station loss per shift is indicated (in lb. of coal), and the equation to the curve [say $C = (1.5\ U$

E

+ 20,000) lb.] gives for any number of units generated the coal consumed. Thus the individual shift performance can be checked and at the same time a watch can be kept on the standing losses. In connection with this Parsons line, the following is an improvement, I think, as it gives greater accuracy. In this it is assumed that if the load (on the station) at the end of a shift is, say, x kW more than at the start of the shift, there is an extra amount of coal, computed at $0.65 \times x$ lb., on the grates at the end of the shift due to this increase in load. This amount of coal is assumed to have been handed over to the next shift, and if this $0.65 \times x$ lb. (whether x be a minus or plus quantity) is allowed for on each shift and the Parsons line is made out on the coal figure thus corrected, this line is, I think, a truer check on the individual shift performance.

In conclusion, it is hoped that these few points will be of some use to the operating engineer, and I would here like to remind him that any falling-off in the efficiency of the operating staff is in any boiler-house immediately and inevitably passed on to the steam-raising plant.

Sir Hugo Hirst in Australia.

Speeches in Melbourne.

SIR HUGO HIRST, Bart., delivered two speeches in Melbourne in November, and reports of both appear in the *Australasian Electrical Times* for November 27th just to hand. The first took place on November 12th at a complimentary dinner given in his honour by business and professional men connected with the Electrical Federation (Victoria). Sir Hugo's "Health" having been proposed by Mr. S. J. Salmon, the chairman, and seconded by Mr. H. P. Brown, Director of Postal Services, he indulged in some reminiscences of his early days in the electrical industry, and stated what had inclined him to remain in England instead of going out to Australia. He said that since the Armistice economics was the politics of the world. The problem of to-day was how to produce economically. How to employ the worker was the problem of the whole world, except perhaps the U.S.A., which was affected differently by the war from all other nations. He had never worked harder in his life than he was doing at present. He was immensely impressed with the possibilities of Australia.

Since coming to Australia, he had found that British manufacturers of motor cars and some electrical lines might possibly find 30 per cent.—not 6 per cent.—of their market in Australia. In Australia, 13,000 miles away from the centre of the Empire, they perhaps did not give enough thought to the economics of the world. They all knew the efficiency of American industry, made possible by its high protection and its 120,000,000 people. Europe had been Balkanised by the Treaty of Versailles, and was saying, "We must make everything in our own country." This was the antithesis of mass production. Things were coming on which might make Europe, economically, a United States. He was one of the people who were expected to make up their minds which way British industry was going—towards Europe or the United States. He felt that either way, they would be left "up in the air." If they did not stand upon their own feet, their dominance would be over. He stood for the Empire.

He thought Australia might steer into a difficult time unless it were fully realised that an efficient standard in industry was necessary, comparable with the standard of living. Otherwise, the country would be living in a fool's paradise, for a fall in values of primary products would bring disaster. He was not criticising, but such a situation must come sooner or later. That could only be avoided by learning the bitter lesson that England had learned, that the two sides must be got together, even while strikes were occurring, and get down to efficiency. He was a protectionist, but he did not believe in protecting everything if there was not efficiency. Inefficient industries might do more towards raising the cost of living than the efficient ones could do to help the country. The electrical industry of Great Britain had every reason to look at itself in the mirror and be proud of its image. They had had artificial protection during the war, and a little protection afterwards. That period of war prohibition was used to put their heads together and create a British school of thought, that in lamps, radio, wires and cables, and other lines, held its own against the world. They had felt the need of rationalisation of industries. The British electrical industry had held its own, and was a good example of that regeneration of industry which had taken place in Great Britain since 1921. He believed that Australia would link up more fully with British industry. In the war it was found that 6-in. guns were no good against 14-in. guns of the enemy, but that was just what was happening in industry in England to-day. He thought that what had been wrested from Nature in 100 years in Australia was beyond everything that he had imagined. He would do the best he could to give information to those at home on the situation in Australia, and he hoped that he would be of use to the Commonwealth as a whole.

Sir Hugo's second Melbourne speech was at the second annual dinner of the Institution of Engineers, on November 22nd, and was delivered in proposing the toast of the "Engineering Profession." He said that the members of the Commission would eventually appear before the Prime Minister and others at Canberra and answer all questions put to them, frankly, truly, and fearlessly, to the best of their ability. From his personal observations, the thing that struck him most was that this great Continent, neglected for centuries by the human race, should have risen to its present position in 125 years. Such development was possible only by the help of engineers. They had great problems for the future. Some of their great factories which he had seen were as efficient as any in other countries. They were living in a world which was fast becoming mechanised. A new vista had been opened up to engineers. In every office and home there were engineering devices, and a great work was before engineers in simplifying these devices and decreasing labour and labour costs. He wished them every success. They had a very great responsibility, but he was sure they would rise to it. British industry had pulled itself together in the last few years. In many directions they were now leading. The thing that was giving them most trouble was the thing that was going to give Australia most trouble—coal! With the coming of oil, coal had been relegated to a secondary position, but he could bring them the message that the best brains in the Old Country were working to remedy the position, and he was satisfied that within comparatively few years that problem would be solved. Whether by low-temperature distillation of coal or by other means, there would be derived from coal enough oil, enough motor fuel, enough fertilisers, enough cheap electricity, for all needs. There were hundreds of thousands of pounds being spent to-day, not in experimental plants, but in large commercial ones, and when their coal problem was solved, Australia's coal problem would be solved also. The need for importing oil from foreign countries would be lessened, and the coal and allied industries would employ more men than ever before. He was full of admiration for the work that had been done by Australian engineers.

The Canberra correspondent of *The Times* says that, taking advantage of the presence of the members of the British Economic Mission, who are paying a farewell visit to the capital, all the State Premiers, with the exception of Mr. Collier, Western Australia, are attending an informal conference with the Prime Minister. The report of the delegation, summarising the results of their Australian tour, was circulated among those present, who were pledged to secrecy as to its contents, pending publication of the report in the Press on January 10th. The report, which is very brief, contains conclusions without stating reasons. A speech by Sir Arthur Duckham, leader of the mission, to Rotarians on January 7th, suggests that the delegation strongly favours a uniform railway gauge from Perth to Brisbane. The realisation that a break of gauge is undesirable for many reasons has lately become widespread, but the cost, estimated at £22,000,000, has been a formidable obstacle hitherto. It is learned from a reliable source that the Economic Mission is prepared to advise that the cost should be borne out of the Imperial grant of £34,000,000 for immigration and development purposes.

Bare-wire Signalling Circuits in Mines.

The Secretary for Mines has issued a circular drawing attention to the Report as to the safety, in the presence of firedamp, of bare-wire signalling circuits in which bells or relays are used in parallel, which was abstracted on p. 26 of our last issue. The managers of mines in which there may be danger from firedamp are advised to study the report and take such steps as may be necessary.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The " Fair " at Birmingham.

In our leaderette pages to-day we discuss arrangements in connection with the Castle Bromwich Section of the British Industries Fair (February 18th to March 1st). It is not too soon for all concerned to sit down earnestly and make plans. The Advisory Committee of the Electrical Section has been set up, again under the chairmanship of Mr. H. H. Berry, with Mr. T. R. Martin as deputy chairman, and with representatives of various electrical institutions and associations as members, Mr. E. J. Jennings continuing to hold the important office of honorary secretary. By courtesy of Mr. Jennings, we are enabled to publish the programme of visits to the Electrical Section. Readers would do well to keep this at hand for reference.

Friday, February 22nd, at 11.30 o'clock—Conference Hall:—

Conference arranged by the South Midland Area Committee of the British Electrical Development Association.

At 1 o'clock—Luncheon in Royal Dining Room, " C " Building:—

Incorporated Municipal Electrical Association.
Incorporated Association of Electric Power Companies.
Provincial Electric Supply Association.
British Electrical Development Association.
Municipal Tramway and Transport Association, Inc.
Tramways and Light Railways Association.

Saturday, February 23rd, at 1 o'clock—Luncheon in Royal Dining Room, " C " Building:—

Electrical Power Engineers' Association.

Also, in the Conference Hall, for an hour, at termination of Luncheon:—

Electrical Power Engineers' Association.

Saturday, February 23rd, at 4.30 p.m.—Tea in Royal Dining Room, " C " Building:—

South Midland Students' Section of the Institution of Electrical Engineers.

Friday, March 1st, at 1 p.m.—Luncheon in Royal Dining Room, " C " Building:—

Institution of Electrical Engineers.
Association of Consulting Engineers, Inc.
Association of Supervising Electrical Engineers.
Electrical Contractors' Association, Inc.
Electrical Contractors' Association of Scotland.
Electrical Wholesalers' Federation, Ltd.
Electrical Merchants' and Manufacturers' Association.
Illuminating Engineering Society.
Association of Mining Electrical Engineers.

At 4.30 p.m.—Tea in Royal Dining Room, " C " Building:—

Electrical Association for Women (Birmingham and Midlands Branch).

For Sale.

Messrs. Henry W. Figg & Son will offer by auction on January 23rd, at Winchester House, Old Broad Street, E.C., the business and assets of Attaix, Ltd. Norwich Electric Tramways Co. has for disposal a complete power-station plant of 1,000 kW. The Yorkshire Electric Power Co. has for sale rotary convertors, motor generators, circuit breakers, &c. Edinburgh Corporation Electricity Department has for disposal a number of steam generating units, &c. (See our advertisement pages to-day.)

New Australian Companies.

Among the companies recently registered in Australia are the following: The Collie Power Co. (Perth, W.A.), capital £150,000, to carry on in Collie and elsewhere in Western Australia the business of an electricity supply company; the Bowraville Electric Supply Co. (Sydney, N.S.W.), capital £20,000; Austral Batteries Pty., Ltd. (Collingwood, Vic.), capital, £10,000; Hoover (Australia), Ltd. (Melbourne), capital, £5,000; Mouldings, Ltd. (Sydney), capital, £15,000, to acquire the assets of the Electrical Accessories and Engineering Co. of Australia, Ltd., &c.; and the Vickery Engineering Pty., Ltd. (Richmond, Vic.), capital, £10,000, to take over an existing business of electrical engineers, contractors, manufacturers, &c.

New Electrical Trade Association.

We have received from Messrs. McMillan & Henderson, accountants and auditors, of 5, High Holborn, W.C.1, particulars of the formation of the British Electrical Trade Protection Association. We learn that a large and representative gathering of electrical manufacturers and factors was held on November 28th, at Anderton's Hotel, London, for the purpose of forming a Trade Protection Association similar to the Scottish Electrical Manufacturers' and Factors' Association whose secretary, Mr. H. C. McMillan, attended, and explained the scheme in detail, and was interrogated on various points. The meeting unanimously appointed a Committee, consisting of Major Hogan (Messrs. Hogan & Wardrop), Mr. F. Hicks (Welsbach Light Co., Ltd.), and Mr. C. Orgel (Superlamps, Ltd.), to prepare the draft constitution and fix the subscription.

At a later meeting the Committee submitted the following recommendations, and they were unanimously adopted:—

1. That an Association be formed, to be called the British Electrical Trade Protection Association.
2. That the subscription be £5 5s. per annum, together with an entrance fee of £5 5s.
3. That the first 100 members be called founder-members, these to be admitted without payment of entrance fee.

A number of recommendations regarding the internal working of the Association were adopted. The preliminary Committee, with the addition of Mr. F. W. Evans (National Electric Supplies, Ltd.), was given powers to carry on the work of the Association until January 15th, 1929, when the first regular monthly meeting of the Association will be held and office bearers for the year elected. It is stated that the response of the trade has been most encouraging. A large number of applications for membership have been received, and it is confidently anticipated that the Association will supply a long-felt want in providing definite protection against doubtful traders; its basis is such that the members' interests are entirely mutual, and every member is interested in supplying the Association with all requisite information within his power. The registered offices are at present at 5, High Holborn, London, W.C.1, with a Scottish branch at 13, Dundas Street, Glasgow, C.1.

Proposed Industrial Heating Exhibition at Swansea.

At a recent meeting of the Swansea Corporation Electricity Committee the question of organising an industrial heating exhibition, similar to those being held in Glasgow and Manchester, was considered. Mr. J. W. Burr, the borough electrical engineer, recommended the proposal as he thought that a great impetus would be given to the use of electricity in local industry. He estimated that the cost to the Corporation of an exhibition would be about £400; energy would have to be supplied to exhibitors free of charge. There would be difficulty in obtaining accommodation in the earlier part of the year. The Committee decided to postpone further consideration of the matter until it could be ascertained whether accommodation could be found during August.

The Australian Electrical Market.

In an editorial entitled "British Electrical Manufacturers and the Australian Market," the *Industrial Australian and Mining Standard* (November 22nd), in the course of a brief review of the situation in this country remarks:—"We in Australia should, as a natural course, have a deep regard for the electrical production industry carried on in Great Britain, and in order that we may give expression to that regard, it is essential that we as a people should from time to time have placed before us the actual facts of the situation so that we may both formulate policy generally, and take action in particular cases as they arise, with adequate intelligent understanding." In referring to the export trade position our contemporary says:—"It behoves British electrical manufacturers to help their overseas organisations by every means in their power, so that their activities may be characterised by a greater zeal and energy. The home office policy has been to a large extent found wanting in recent years. There is much talk in England at present about the need for introducing greater efficiency and spirit into British salesmanship overseas. Surely it is up to the British electrical manufacturer and trader to act with enterprise in organising to supply this

country. The present system of tendering in Australia is, we regret to say, very far from satisfactory to all overseas firms. We have had to draw attention to some glaring instances of 'parochialism,' to put it mildly, on more than one occasion in this connection. Competing electrical peoples are only too ready to cater for the requirements of our market. Britain holds a very large share of our electrical business, but can she expect to continue to do so in face of keener foreign competition unless her producers face up to the needs of the situation, so far as publicity and salesmanship are concerned, and show readiness to foot the bill? . . . Link up Australian preferential policy to a policy of wideawake activity on the part of the British trader, giving our buyers an accurate knowledge of the situation of the British industry, and the ability of her works to meet our needs at a reasonable price, with a first-class article, and there need be fewer drops in the trade curve. We commend the wisdom of adopting an aggressive trade policy throughout Australia to the British electrical industry."

Floodlighting in a Church.

We reproduce herewith a photograph taken in the parish church of All Saints, Maidstone, by the light provided by a new installation which has been carried out by Messrs. G. E. WALLIS & SONS, LTD. The floodlighting of the nave, aisles and chancel has been effected by means of 64 "Gecoray" projectors, each fitted with a 200-W gasfilled, white-sprayed "Osram" lamp. The result, as will be judged from the illustration, is extremely good.

Floodlighting in All Saints' Church, Maidstone.

Calendars and Diaries.

The 1929 wall calendar issued by CALLENDER'S CABLE & CONSTRUCTION CO., LTD., presents a large framed portrait in colour of Sir T. O. Callender, the managing director and deputy chairman of the company.

A calendar received from the BRITISH B.A.G., LTD., 23, Farringdon Avenue, E.C.4, bears illustrated instructions for wiring the "Lomax" patent lampholder. It has monthly date slips.

Messrs. BROOK MOTORS, LTD., Empress Works, Huddersfield, have sent us a metal foot rule with British and metric markings.

The calendar received from BRITISH BROWN-BOVERI, LTD., Trafalgar House, Waterloo Place, S.W.1, is a very handsome production consisting of monthly sheets, each of which bears an illustration of the parent company's works and products.

The COUNTY OF LONDON ELECTRIC SUPPLY CO., LTD., 46-47, New Broad Street, E.C.2, has again sent us a telephone number card, upon which electric power is symbolised.

Mr. GEORGE P. COSWAY, Coton Road, Nuneaton, has sent us a useful wall calendar with large monthly sheets.

Humorous drawings by Will Owen enliven the two-monthly sheets of a calendar received from the ENGINEERING & LIGHTING EQUIPMENT CO., LTD., Sphere Works, St. Albans.

The "Cosmos" girl appearing on the 1929 calendar of METRO-VICK SUPPLIES, LTD., Trafford Park, Manchester, is a charming *ingénue* by Bert Wilson. Beneath the picture is a block of daily slips.

The ELECTRICAL TRADES COMMERCIAL TRAVELLERS' ASSOCIATION has sent us a neat pocket diary, a feature of which is a directory of towns giving post times and other useful information, local holidays, &c.

From MESSRS. WM. SANDERS & CO., of Falcon Electrical Works, Wednesbury, we have received a souvenir in the shape of a vest pocket fuse-wire carrier.

On each monthly sheet of a wall calendar sent by MESSRS. PETTERS, LTD., Yeovil, is a photographic reproduction of one of the company's engines or generating sets.

New Zealand's Electrical Imports.

The *Board of Trade Journal* reports that during the September quarter of 1928 electrical apparatus and appliances to the value of £533,886 were imported into New Zealand. The United Kingdom was the principal supplier, with a share valued at £309,576. Then followed the United States (£105,222), Canada (£40,821), and Australia (£7,944).

Customs Tariff Alterations.

In accordance with its usual practice, the first issue of the *Board of Trade Journal* for the year (January 3rd) contained a review of the more important alterations in Customs tariffs made during 1928 by foreign powers and British Dominions. Reference was also made to changes in contemplation.

Recent Contracts.

In our issue of October 12th we gave a list of tenders submitted for the Cairo-Alexandria trunk telephone cable, comprising the names of six British and two German companies. Later, on October 26th, we reported that the offer of the PIRELLI-GENERAL CABLE WORKS, LTD., had been accepted, and it is now stated that the value of the contract is £193 000. The cable will be made at the company's Eastleigh (Hants.) factory, and the work of installation is expected to occupy about eight months.

The Rotterdam Municipality has placed an order with the METROPOLITAN-VICKERS ELECTRICAL CO., LTD., for two 42,000-kW turbo-generators. There was keen Continental competition for the contract. The Metropolitan-Vickers Co. has also received a contract for 21 electric locomotives for the Great Indian Peninsula Railway. The value of these two orders is stated to be about £500,000.

BRITISH INSULATED CABLES, LTD., has received orders from the G.P.O. for a telephone cable between Preston and Blackpool, a distance of approximately 21 miles. This is the second cable that has been laid by the company between these two towns. The B.I. has also received an order for approximately 16 miles of telephone cables for the Isle of Man. These cables are to link up Douglas, Castletown, and Port Erin with the mainland through the new submarine cable, which is shortly to be laid between Fleetwood and Douglas.

The ALTON BATTERY CO., LTD., has recently received orders for nine batteries for Sydney, Melbourne and Tasmania. Further recent contracts cover batteries for Mansoura (Egypt), and Lisbon.

ALLOY WELDING PROCESSES, LTD., has secured the contract for the supply of a motor-generator arc-welding plant for two operators for the Assam-Bengal Railway Co. This machine is to be fitted with the company's latest B.P. type dynamo, which is a self-stabilising, drooping-characteristic machine. The special features of the generator are that no separate series resistance, reactors, or transformers are required, nor is separate excitation necessary. The company has supplied similar and special equipment to a number of important railway undertakings, dockyards, &c.

The MEDICAL SUPPLY ASSOCIATION, LTD., has received instructions from the Lord Mayor of Buenos Aires to supply a very large quantity of ultra-violet light, massage, static electrical, high-frequency, radiant-heat, and electro-medical apparatus generally, for the equipment of the Institute de Radiologia, Buenos Aires. The whole of the equipment will be manufactured in the company's London works.

In our "Contracts Closed" section we give a list of sub-contracts in connection with the Hams Hall power station, Birmingham, which have been placed with the GENERAL ELECTRIC CO., LTD. (for the electrical equipment) and other companies.

Important French Amalgamation.

It is announced that the fusion of interests between the two important French electrical engineering undertakings, the Société Alsacienne de Constructions Mécaniques, of Belfort, and the Compagnie Française pour l'Exploitation des Procédés Thomson-Houston, which has half a dozen works in different parts of France, has now been completed. The joint business will in future be carried on under the title of La Société Générale de Construction Electrique et Mécanique Alsthom, with headquarters at 146, Avenue des Champs Elysées, Paris. Only the cable and wire, battery and signal manufacturing departments of the Thomson-Houston Co. remain outside the amalgamation.

Staff for New Bristol Station.

The Bristol Corporation Electricity Committee reports that it is desirable to appoint the preliminary staff for the Portishead generating station, which will be rated as a class "H" station under the salary scale approved by the National Joint Board for the Electricity Supply Industry. It therefore recommends that it be authorised to appoint a station superintendent at a salary of £672 per annum, and a boiler-house superintendent at a salary of £511 per annum.

Bankruptcy Proceedings.

F. PRICE, 9, Gold Street, and C. R. TARVER, 16, Forrest Street, lately trading as Fred Price, Tarver & Co., 15, Working Street, Cardiff, electrical engineers.—The first meeting of creditors was held on December 31st at Cardiff. The debtors returned a statement of affairs showing ranking liabilities of £713, against assets of £88, leaving a deficiency of £625. The debtors attributed their failure to trade depression.

J. W. TURTON, Market Place, Banbury, Oxon., electrical engineer.—The receiving order herein was made recently on the debtor's own petition. The first meeting of creditors was held recently at Oxford, when the case, being a summary one, was left in the hands of the Official Receiver as trustee of the estate.

W. L. BROWN, trading with another as Sewell & Brown, electrical and radio engineers, 6a, The Exchange, Muswell Hill.—Discharge suspended for six months until May 27th.

W. P. HODGE, wireless salesman, 92, Cannon Street, E.C.4.—Discharge suspended for two years until November 30th, 1928. (?1930).

H. J. BROWNHILL, electrical engineer, back of 48, Whitehouse Street, Walsall.—Order for summary administration made December 20th. First meeting January 11th, at the Official Receiver's Office, 30, Lichfield Street, Wolverhampton. Public examination February 20th, at the Court House, Lichfield Street, Walsall.

B. E. M. POOK, 53a, Albert Road, Southsea, Hants., wireless dealer.—First and final dividend of 3½d. in the £, payable January 12th at the Official Receiver's office, 87, High Street, Portsmouth.

C. K. WALLIS, electrical engineer, Bedford Street and Longford Road, Bognor.—Application for discharge to be heard February 14th, at the Court House, Brighton.

Company Liquidations.

BURGOYNE MANUFACTURING CO., LTD., 34a, York Road, London, N.1, radio manufacturers, &c.—A meeting of creditors was held on December 28th at the offices of Messrs. W. Meacock & Co., 123, Cannon Street, E.C., when the liquidator, Mr. R. W. Meacock, reported that the company was incorporated on May 29th, 1928, with a nominal capital of £500, divided into 10,000 shares of 1s. each, to adopt and carry into effect an agreement transferring to the company a radio manufacturing, &c., business, in consideration of the allotment of 9,993 ordinary shares, credited as fully paid. Six shares were allotted for cash, in respect of which 5s. had been paid. The trading of the company was not successful, and on August 28th last, Messrs. W. B. Fordham & Sons, Ltd., were granted a debenture for £4,000 as security for an amount due to them. On October 1st last Mr. E. D. Hine was appointed receiver and manager, and carried on the business until November 30th, when all the assets were transferred to a new company formed to continue the business. The assets transferred to the new company consisted of stock at cost approximately £1,500, valued at £1,250; debtors £1,750, valued at £1,050; plant £15, and furniture £26. The small cash balance in the hands of the receiver at that date was insufficient to pay his remuneration. The amount due to W. B. Fordham and Sons, Ltd., was £4,383, and £1,500 was due for debts to other creditors guaranteed. From those amounts had to be deducted £2,250 as the value of the security afforded by the debenture, leaving £3,633. With other creditors' claims the deficiency was £5,308. No accounts had been prepared, and the liquidator said that in view of the state of the books, it would appear that the preparation of any accounts would involve unjustifiable expense. The deficiency was accounted for by trading losses, bad debts, loss on realisation of furniture and plant, costs of formation of the company, remuneration of the Receiver, and costs of liquidation. It appeared that the sales barely covered the cost of materials consumed. No resolutions were passed, and therefore the voluntary liquidation of the company will continue with the present liquidator.

NEW WILSON ELECTRICAL MANUFACTURING CO., LTD., 18, Fitzroy Street, Fitzroy Square, W.1, wireless and electrical factors.—A meeting of the creditors of the above was held on January 2nd at the offices of the liquidator, Mr. R. Y. Rickard, 65, Basinghall Street, E.C. Mr. Rickard reported that the liabilities amounted to £1,569, and the assets totalled £1,134. From that amount had to be deducted £308 for preferential claims, leaving net assets of £826. The company was incorporated in July, 1925, to acquire certain rights in patent articles. The trading was successful for the first two years, but in the third year there was a loss. Since that date, to the time of liquidation, a further loss had been sustained. The sales during the whole time of the company's trading were £29,565, and there was a gross profit of £10,843. After deducting expenses, &c., there was a net profit of £1,820. It was resolved to confirm the voluntary liquidation of the company with the present liquidator.

BELL'S UNITED ASBESTOS CO., LTD.—Winding up voluntarily for the purpose of amalgamating the business with that of Turner & Newall, Ltd. Liquidators, Mr. S. R. Cooper, 14, George Street, E.C.4, and Mr. F. G. Brook, 41, Compton Road, Winchmore Hill, N.21, appointed December 31st. A meeting of creditors will be held on January 18th at Asbestos House, Southwark Street, S.E. (This notice is purely formal; all creditors have been, or will be, paid in full.)

VACUUM POWER, LTD., & VACUUM LIGHT & POWER, LTD.—Particulars of claims to be sent by January 14th to the liquidator, Mr. E. J. Tubbs, Devonshire Chambers, Bishopsgate, E.C.2.

INDUCTION MOTORS (LONDON), LTD.—A meeting is to be held on February 4th, at 19, Leys Avenue, Letchworth, to hear an account of the winding up from the liquidator, Mr. T. Keens, 11, George Street West, Luton.

SHAW & ADAMS, LTD.—Winding up voluntarily. Liquidator, Mr. C. F. J. Taft, Victoria Chambers, St. Peter's Churchyard, Derby, appointed December 28th. A meeting of creditors is called for January 16th at the North Stafford Hotel, Stoke-on-Trent.

VOLTA, LTD.—Winding up voluntarily as already announced. Liquidator, Mr. A. N. D. Smith, 80, Finsbury Pavement, E.C.2, appointed December 31st. A meeting of creditors is called for January 17th at the liquidator's offices.

MOHAWK RADIO, LTD.—Winding up voluntarily. Liquidator, Mr. A. A. Reeves, 2, Tyrrel Street, Bradford, appointed December 27th. A meeting of creditors at 50, Gresham Street, E.C.2, is called for January 15th, and particulars of claims are to be sent to the liquidator on or before that date.

WATERHOUSES (ELECTRICIANS), LTD.—A general meeting of members is called for February 4th at Court Chambers, Jessop Street, Castleford, Yorks., to hear an account of the winding up from the liquidator, Mr. F. W. Hanson.

Dissolutions of Partnership.

MORLEY & BOOTH, Star Buildings, Newcastle-upon-Tyne, electrical engineers and agents.—Messrs. F. H. Morley and H. C. Booth have dissolved partnership. Mr. Morley will continue business at Star Buildings, and Mr. Booth will carry on business at 20, Saville Row, Newcastle.

AIRD & SCOTT, electrical engineers, 1,036, Argyle Street, Glasgow.—Mr. W. Aird and Mr. W. Scott have dissolved partnership. Mr. Scott will attend to debts and continue the business under the style of W. Scott, at 1,036, Argyle Street.

Unemployment in Germany.

The Berlin correspondent of *The Times* reports that German unemployment figures show the sharp rise characteristic of the mid-winter period in several recent years. The total number of persons in receipt of relief at the end of December was 1,417,000, as compared with 647,000 in July, the lowest total of the year. As a contributory cause there has been the shipyard strike, which affected some 50,000 men directly, and has been in progress since October 1st, work having been at a standstill in nearly all the Baltic and North Sea yards.

Irish Free State Electrical Imports.

The Irish Free State Ministry of Industry and Commerce has issued detailed figures of imports during the nine months ended September 30th last, comparing them with the corresponding period of 1927. From these we have compiled the appended table, showing the value of the total imports of electrical machinery and apparatus into the Free State and the amount attributed to the United Kingdom, as country of shipment but not necessarily of manufacture:—

	Total imports. Jan. to Sept.		U.K. share. Jan. to Sept.	
	1927. £	1928. £	1927. £	1928. £
Electric wires and cables	84,959	147,229	33,980	10,487
Telegraph and telephone instruments and apparatus ...	31,104	7,268	24,320	5,933
Electric lamps and parts	31,990	37,002	26,694	26,119
Batteries and accumulators	25,536	19,365	24,502	17,706
Radio sets and parts	48,554	53,892	47,473	53,077
Other electrical goods and apparatus ...	57,746	73,115	44,284	42,932
Generators	9,283	8,020	8,703	6,758
Motors	14,385	26,001	11,161	14,004
Other electrical machinery	55,476	69,524	49,049	42,348
Totals ...	£359,033	£436,106	£270,166	£249,364

As will be seen, of the total imports, only £249,364, or approximately 57 per cent., as against over 75 per cent. in 1927, came from ports of the United Kingdom, leaving £186,741 for foreign countries, the bulk of which is credited to Germany.

Trade Announcements.

The ELECTRIC HEATING CO., Croydon, has appointed Bedford Electro Heaters, Howbury Street, Bedford, as sole agents for Lancashire.

The offices and stores of Messrs. HARWELL, LTD., have been removed to the The Sessions House, Clerkenwell Green, E.C.1.

The businesses of Messrs. J. J. GRIFFIN & SONS, LTD., and BAIRD & TAILOCK, LTD., have been combined under the name of GRIFFIN & TATLOCK, LTD. The conduct of the business will be continuous and unchanged.

The REVO ELECTRIC CO., LTD., states that the telegraphic address of its new London depôt, 30, Great Queen Street, W.C.2, is "Revolect, Westcent, London."

This week the WELSBACH LIGHT CO., LTD., opened a new electrical showroom at Welsbach House, 344, Gray's Inn Road, W.C.1. Some particulars of this will appear in our next issue.

With reference to the death of Mr. Clark, reported in a recent issue, it is announced that the business of Messrs. C. O. Clark, electrical engineers and contractors, of London, Deal, and Horsmonden, will be continued by the same staff, and with Mr. M. F. Clark as prinicpal.

For many years past Messrs. V. G. MIDDLETON & CO., LTD., 9, Carteret Street, S.W.1, have worked in close agreement with Messrs. W. J. FURSE & CO., LTD., of Nottingham. To strengthen this connection the name of the company has been altered to W. J. FURSE & CO. (LONDON), LTD. No other alteration will be made; Mr. F. W. Marshall, who has been managing director since the formation of the company, will continue to act in that capacity.

New Showroom at Worksop.

The new showroom of the Worksop Electricity Department (chief engineer and manager, Mr. M. S. Mason) was opened recently. The premises consist of a double-fronted shop, with

A Corner of the New Worksop Showroom.

offices and workshops at the rear, situated in Bridge Street. A view of part of the interior, arranged as a lounge, is reproduced herewith. A dinner to which the staff was invited was held in the evening of the opening day.

The F.B.I. and Penny Postage.

In a recent letter to the Chancellor of the Exchequer, the Federation of British Industries again drew attention to the importance of the early restoration of the Imperial penny post. Reference was made to the recent decision of the Canadian Government to reinstitute penny postage, and the Government was urged not to lag behind the Dominions in such a vitally-important matter.

Social Events.

Following the annual conference of the indoor and outdoor sales staffs of Messrs. John Shaw & Sons (Wolverhampton), Ltd., just before Christmas, the annual staff dinner was held at the Victoria Hotel, Wolverhampton. Mr. V. A. Mattick, the general manager, presided, and Mr. T. W. Simpson, a director, was present. Messages regretting their inability to be present were received from Mr. George Terrell, chairman, who is abroad, and Sir Harry Greer, deputy-chairman.

The Badminton Section of the G.E.C. Social Club held its annual dance in the Lecture Room at Magnet House on December 21st, when there was a large attendance. The arrangements, which were in very capable hands, coupled with the festive spirit prevailing, ensured a very enjoyable evening.

Once a month the employés of Messrs. H. E. Ashdown, Ltd., meet their employers for a jolly evening together. A Social Club was formed twelve months ago, and members invite friends to all the club's social functions. A fancy dress dance was held on December 20th, when over 200 spent a very enjoyable evening. During the evening a presentation was made to Miss G. Claydon, who has been employed with the company for nine years.

The Birmingham City Electric Supply Department's Christmas pantomime was very successful. All the performers were children of the employés, who gave a clever interpretation of "Sinbad the Sailor." The Lord Mayor, Councillor W. B. Kenrick, and Mr. E. J. Jennings (secretary of the Electric Supply Department) attended. The play was written by Mr. G. H. Luke, and the producers were Messrs. R. New and F. J. Tivet. An amateur orchestra, under the direction of Mr. F. A. Wolverson and conducted by Mr. J. Aspin, rendered excellent service.

New Catalogues and Lists.

THE STANDARD WET BATTERY CO., 184-188, Shaftesbury Avenue, W.C.2.—Two illustrated booklets dealing with the use and maintenance of the company's Leclanché batteries for radio work and a leaflet advertising the "Wates" volt-amp. meter. Priced.

MESSRS. BAXTER & CAUNTER, LTD., 219, Tottenham Court Road, W.1.—January price list of electrical supplies, fittings, and apparatus. Illustrated.

BRITISH INSULATED CABLES, LTD., Prescot, Lancs.—Three publications, dealing respectively with "Coraline" soldering paste, electric resistance welding, and welding used in the assembly of "Ford" cars.

SIEMENS ELECTRIC LAMPS & SUPPLIES, LTD., 38-39, Upper Thames Street, E.C.4.—Catalogue No. 172, containing illustrations, details, and prices of the company's shop-window lighting equipment.

MESSRS. J. P. HALL & CO., LTD., Blackriding Iron Works, Oldham.—Booklet No. 64, containing 72 pages of illustrations of motors and generators and numerous applications.

MESSRS. ELLIOTT BROS. (LONDON), LTD., Century Works, Lewisham, S.E.13.—A series of catalogue sheets illustrating and describing the company's meters for laboratory and general use. Priced.

Further January calendar-blotters have been received from the JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, S.W.1; and Messrs. S. ROGERS & CO., LTD., 15, Fitzroy Street, Tottenham Court Road, W.1.

MESSRS. L. G. HAWKINS & CO., LTD., 30-35, Drury Lane, W.C.2.—A circular letter to dealers containing a special offer in connection with "Universal" vacuum cleaners. Also leaflets advertising other "Universal" appliances.

MR. GEORGE P. COSWAY, Coton Road, Nuneaton.—Two blotters, advertising, respectively, wireless apparatus and service, and the "Drednort" link box.

The VISCO ENGINEERING CO., LTD., 162, Grosvenor Road, S.W.1.—Catalogue No. 283, illustrating and describing the "Visco-Beth" dust-collecting apparatus.

Book Notices.

"Window Display Advertising," by Carl Percy. Pp. xiv+208; figs. 60. London: The Library Press, Ltd. Price 21s. net. In this well-printed and illustrated volume the author, an American publicity expert, makes a study of the various factors which contribute to the success of a window display, and shows how results may be gauged with some degree of certainty. Mr. Percy considers that the retailer should not be expected to do all the work himself; he maintains that the manufacturer should assist and show the retailer how to use his window space to the best advantage.

"The *Wireless Trader* Year Book and Diary, 1929." 390 pp. London: The Trader Publishing Co., Ltd. Price 5s. 6d. post free.—The principal addition to this, the fifth, edition of the Year Book is a section covering the gramophone industry with which the radio trade is entering into closer relationship. This is extended also to the technical data section. All the usual features have been retained and brought up to date, although, in view of the recent Marconi patent royalty litigation, the summary of the "A.2" licence granted to manufacturers has been omitted.

"An Introduction to Electrical Drawing," by E. H. H. Gibbins, B.Sc. (Hons.) (Lond.). Pp. 63; illustrated. London and Glasgow: Blackie & Son, Ltd. 3s. net.

"Broadcasts to Schools," programme and syllabus for the spring term, January to March, together with new series of pamphlets; also syllabus of talks and lectures for the period January to April. London: British Broadcasting Corporation.

German Electrical Contractors' Conference.

The annual congress of the German Association of Electrical Installation Contractors was recently held in Munich, when it was announced that the body now has 400 centres and 9,500 members. The association has for some time been endeavouring to discover a better word than the French one at present used, "*installateur*," to denote the profession. The matter was eventually referred to one of the German philological institutes, which, however, has reported that it has not been able to decide upon a more suitable German word.

New Argentine Company.

The Fabrica Argentine de Lamparas Electricas, S.A., recently formed in Buenos Aires with a capital of $250,000 (paper) is to manufacture electric incandescent lamps, sell electrical materials, &c.

Asbestos Companies' Amalgamation.

An amalgamation of the undertakings of Bell's United Asbestos Co., Ltd., and Turner & Newall, Ltd., has been completed. An independent company styled Bell's Asbestos and Engineering Supplies, Ltd., has been formed to take over a branch of Turner & Newall, Ltd., and to deal directly with users of packings, jointing and general engineering supplies.

Central Electricity Board Contracts.

In this issue the Central Electricity Board calls for tenders for the supply, delivery, and erection of 132-kV outdoor switchgear for the transformer stations in the area covered by the Central England Electricity Scheme; also for the supply, delivery and erection of 132,000-V transformers for the above scheme. The Board also invites tenders in this issue for the supply, delivery, and laying of 66,000-V cables (London area) for the South-East England Electricity Scheme.

Prices of Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, &c.	Price Jan. 8th.	Fortnight's inc or dec.
c	Acid, Oxalic ... ... per lb.	8½d.	...
c	Ammoniac, Sal ... ... per ton.	£60	...
c	Ammonia, Muriate (large crystal) ,,	£52	...
c	Bisulphide of Carbon ... ... ,,	...	...
c	Borax ... ... ,,	£25	...
c	Copper Sulphate ... ... ,,	£25 10s.	...
c	Potash, Chlorate ... ... per lb.	8½d. to 4d.	...
c	,, Perchlorate ... ... ,,	5½d.	...
c	Shellac ... ... per cwt.	£18 10s.	...
c	Sulphur, Commercial ... ... ,,	£11	...
c	,, Roll ... ... ,,	£11	...
c	Soda, Chlorate ... ... per lb.	8d.	...
c	,, Crystals ... ... per ton.	£5 to £5 5s.	...
c	Sodium Bichromate, casks ... per lb.	5½d.	...
	METALS, &c.		
b	Aluminium, Ingots ... ... per ton.	£95 to £100	...
b	,, Wire ... ... per lb.	1/1 to 1/9	...
b	,, Sheet ... ... ,,	1/1 to 2/9	...
p	Babbitts Metal and Anti-friction Metal—		
	Grade I ... ... per ton net.	£202	£1 dec.
	Grade II ... ... ,, ,,	£141	...
	Grade III ... ... ,, ,,	£76	£2 inc.
c	Brass (rolled metal 2" to 12" basis) per lb.	10⅜d.	½d. inc.
c	,, Tubes (solid drawn) ... ... ,,	1/0½ to 1/0¾d.	½d. inc.
c	,, Wire, basis ... ... ,,	10⅝d.	½d. inc.
c	Copper Tubes (solid drawn) ... ,,	1/2d.	½d. inc.
c	,, Bars (best selected) ... per ton.	£102	£4 inc.
c	,, Sheet ... ... ,,	£102	£4 inc.
c	,, Rod ... ... ,,	£102	£4 inc.
d	,, (Electrolytic) Bars ... ... ,,	£75 5s.	...
d	,, ,, Sheets ... ,,	£148 10s.	...
d	,, ,, Wire Rods ,,	£85 5s.	...
d	,, ,, H.C. Wire per lb.	10⅞d.	...
f	Ebonite Rod ... ... ,,	2/8 to 2/8	...
f	,, Sheet ... ... ,,	2/8 to 2/6	...
a	German Silver Wire ... ... ,,	2/3	...
h	Gutta-percha, fine ... ... ,,	nom.	...
h	India rubber, Para fine ... ... ,,	10½d.	...
f	Iron Pig (Cleveland No. 8.) ... per ton.	75/-	...
f	,, Wire, galv. No. 8, P.O. qual. ,,	£21	...
g	Lead, English pig ... ... ,,	£23 10s.	£1 inc.
g	Mercury ... ... per bot.	£22 5s. to £22 15s.	...
c	Mica (in original cases) small ... per lb.	8d. to 8/-	...
c	,, ,, medium ,,	4/- to 8/-	...
c	,, ,, large ... ,,	10/- to 20/- & up	...
p	Phosphor Bronze, plane castings ,,	1/3½	...
p	,, ,, drawn bars & rods ,,	1/8½	...
p	,, ,, rolled strip & sheet ,,	1/8½	...
p	,, ,, wire... ... ... ,,	1/4½	½d. inc.
c	Platinum ... ... per oz.	£16 5s.	£1 inc.
d	Silicium Bronze Wire ... ... per lb.	11½d.	...
r	Steel, Magnet, in bars ... ... ,,	7½d.	...
n	Tin, Block (English) ... ... per ton.	£225 5s. to £225 10s.	30/- to 35/- inc.
n	,, Wire, Nos. 1 to 16 ... ... per lb.	3/11	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

In their letter dated January 5th, Messrs. James Forster and Co. stated that a rise in lead prices occurred last week, but they receded later. The rise was probably initiated, in the first place, by sentiment owing to the better tone in other metals, but the firm conditions brought about a fair amount of buying by home consumers for early delivery. As soon as that buying had spent itself, prices dropped back. Supplies of lead are ample, while it is expected that arrivals this month will be pretty full; in fact, declarations of "Burma" refined lead have already made their appearance. December shipments from Australia are reported as 12,362 tons, so that for the next two months there will be no shortage of lead from that quarter. "Although we consider the intrinsic position of lead sound, we think that under present conditions the price is quite high enough. Should, however, demand on the Continent revive, higher prices may be seen in the near future."

Lighting and Power Notes.

Alresford.—ELECTRICITY SUPPLY.—It was recently reported to the Rural District Council that the Hampshire Electricity Co. proposes to apply for powers to supply electricity to the district. A similar order is being applied for by the Alton Electricity Co.

Birmingham.—CHANGE OF FREQUENCY.—The Birmingham Electric Supply Committee, in a report to the City Council (at its meeting on January 8th) referred to the Central England Electricity Scheme, and the Committee reported that on September 28th the Central Electricity Board formally called upon the Corporation to make the necessary arrangements for changing the frequency of supply from 25 to 50 cycles. It had been arranged for the Board to finance this work in such a manner that no expense would fall on the Corporation. A local engineer had been appointed by the Board, and local offices established.

It had been agreed that the Board should install two 18,750-kW frequency changers at Nechells (Prince's) Station, which would enable the Corporation to supply 50-cycle current from the 25-cycle machines as a temporary measure, and for one of the large generating sets at Hams Hall power station to be rewound for 50-cycle supply. It would take twelve months to install the frequency changers referred to.

ASSISTED WIRING SCHEME.—The Committee gave particulars of a scheme which it had just brought into operation for wiring premises. The work would be done by registered contractors to a specification prepared by the Department. Contracts had been entered into with all registered contractors who were prepared to carry out the wiring at schedule prices, and the work would be spread as evenly as possible amongst the contractors on the rota.

EMISSION OF GRIT.—The grit catchers which are operating successfully where ordinary slack is being consumed are not found to be so successful in the case of pulverised fuel. In order to cope with this new problem, the experiment has been tried of fitting a second catcher behind the first on one of the chimneys, resulting in a marked improvement. Similar additions will be made to the other chimneys over the pulverised fuel furnaces. Meanwhile, in order to reduce the total quantity of ash that has to be dealt with in the pulverised fuel boilers, only fuel having a low ash content is being burnt in them at a considerably increased cost. The Committee has already spent £61,000 upon the problem, apart from the extra cost of fuel.

Carnarvon.—ELECTRICITY SUPPLY.—Attention is being given to the situation that will arise when the Corporation's agreement with the National Electric Construction Co. expires this year. A committee, which has been investigating the matter, has presented a report to the Chamber of Commerce which states that up to six years ago the company had been carrying on at a loss. Since then, however, there had been a profit of £1,700. The Committee is unable to come to any conclusion as to whether the time is opportune for the Corporation to take over the whole responsibility for giving an electricity supply, but is of the opinion that the company should be asked to state its terms for the renewal of the existing agreement.

Canada.—NIAGARA FALLS TREATY.—The Ottawa correspondent of *The Times* reports that on January 2nd Mr. Mackenzie King, the Prime Minister, and Mr. Phillips, the United States Minister, signed a treaty embodying the recommendations of the joint board of engineers which studied the problems connected with Niagara Falls. Its terms will authorise the construction of new works which will reduce the process of erosion and preserve the scenic beauties of the Falls, at the same time making an additional 10,000 h.p. of electricity available for distribution in each country.

HYDRO-ELECTRIC DEVELOPMENT.—The Gatineau Power Company has commenced construction on another storage dam on the Gatineau River, in Quebec Province. The new dam storing the waters of Lake Cabonga, and the present Mercier storage dam will form reservoirs ranking with the largest storage systems of the world. The new structure, known as the Cabonga dam, will create a reservoir of 45,000,000,000 cu. ft. capacity, and will be situated 46 miles above the Mercier dam, the two having a combined storage of 145,000,000,000 cu. ft. Work will be carried on throughout the winter, and it is expected that the dam will be completed and ready for operation next summer. Its construction will materially assist in regulating the flow of the Gatineau River, on which the Gatineau Power Company has completed three hydro-electric plants within the last two years. Two of the stations are within six miles of Ottawa, and designed for a combined capacity of 290,000 h.p., of which 232,000 h.p. is installed or being installed. The third station, known as the Paugan, 35 miles north of Ottawa, which came into operation on October 1st with a delivery of 80,000 h.p., has an installed capacity of 204,000 h.p.

The Vancouver correspondent of the *Financial Times* reports that the construction of another hydro-electric project at

Ruskin at an expenditure of £1,450,000, and an enlargement of the Bridge River plant, at a cost of £200,000, are announced by the British Columbia Power Corporation. The additional development is planned in the belief that all previous estimates of Vancouver's growth will be exceeded.

Chester.—ELECTRICITY IN BULK.—The Electricity Distribution of North Wales & District, Ltd., has applied to the City Council for a supply of electricity in bulk in order to give a supply to Holt, Bunbury and district. The Electricity Committee is to communicate with the Electricity Commissioners with regard to the request.

Colchester.—EXTENSION OF SUPPLY.—The Corporation Electricity Committee has considered revised estimates of the cost of the proposed double transmission line for the supply of electricity to Wivenhoe urban district, and ultimately to Rowhedge, and has decided to apply for sanction to a loan of £8,536 (in lieu of £6,500), made up as follows: Purchase price of undertaking belonging to the Wivenhoe Electricity Company, £2,150; cost of application for Special Order by the Wivenhoe Council, £275; estimated cost of transmission line from the Hythe (Colchester) generating station to Wivenhoe, £4,776; mains services, &c., in Wivenhoe, £1,260; and contingencies, £75.

Continental.—RUSSIA.—The Glavelektro, headed by M. Korostashevski, has completed its work of investigating the electricity supply and the electrical industry of Leningrad. As regards the supply of electricity to the town, the Commission's investigations showed that the situation would still be difficult in spite of the imminent extensions of steam power works and the building of the Svir station. It therefore considers it necessary to equip a steam power house of 100,000 to 150,000 kW. The fuel used would be peat. Negotiations are proceeding for the use of American credits amounting to $25,000,000, and the *Commercial and Industrial Gazette* says that possibly the Americans will help in the scheme, not only by supplying the electrical machinery, but also by taking part in the construction of the station.—*Reuter's Trade Service* (Moscow).

Crawley (Sussex).—INQUIRY RESULT.—In connection with the local inquiry held recently by the Ministry of Transport into the application by certain consumers for a revision of the maximum charges for electricity supply by the Sussex Electricity Supply Co., Ltd., the company has received a communication from the Ministry stating that after consideration of the evidence given at the inquiry, of the inspector's report and other circumstances of the case, the Minister of Transport has decided not to make an Order in the matter.

Dover.—LOANS SANCTIONED.—The Corporation has received sanction to the borrowing of £2,280 for mains, and £1,520 for switchgear.

Forfar.—INAUGURATION OF SUPPLY.—An electricity supply for the district was inaugurated on January 1st. The supply is given from the Arbroath power station.

Hoylake and West Kirby.—NEW TARIFF FOR OUT-DISTRICTS.—In view of the arrangements that are being made to give a supply of electricity to Frankby and Grange, the Urban District Council has drawn up a special tariff, details of which are as follows: (*a*) A fixed charge equal to 25 per cent. per annum of the ratable value of premises, plus ¾d. per kWh for all electricity consumed (accounts payable quarterly); (*b*) a fixed charge equal to 12½ per cent. per annum of the annual ratable value of the premises, plus 1½d. per kWh for electricity consumed (accounts payable quarterly), minimum ratable value assessment £18 per annum.

Hull.—LOAN SANCTIONED.—The Corporation Electricity Committee has received sanction to the borrowing of £46,375 for the supply of electricity to the western outskirts of the city.

Lancaster.—ELECTRICITY SCHEME.—Messrs. Thomas Wilkinson, Ltd., of Arnside, have prepared a scheme for the supply of electricity from the waste gases of the Carnforth Ironworks, and their proposals were recently examined at a special meeting of the Rural District Council. The firm proposes to supply the parishes of Silverdale and Warton-with-Lindeth in the scheme for the whole of Westmorland, and sets out its plan in a letter to the Council which states that even if the furnaces at Carnforth were closed down temporarily, it would be able to use the Government's grid and thus be able to maintain a continuous supply. It had already had an interview with the Central Electricity Board and the Electricity Commissioners, which was satisfactory. It was proposed to supply electricity in the parishes at a rate of 1½d. per kWh for power and 8d. per kWh for lighting. The station to be erected was to be 12,000 kW, and the firm hoped to be in a position to make an early start as all the necessary capital for the undertaking had already been found. The Council has decided to refer the matter to the parishes concerned and then to further review the situation.

Leeds.—ELECTRICITY CHARGES.—The Corporation Electricity Committee has recommended the following alternative charge for the supply of electricity to consumers requiring large quantities for lighting purposes. A fixed charge at the rate of £10 per kW of maximum demand plus a "unit" charge of 0.5d., provided that the annual requirements for lighting shall not be less than 100,000 kWh, and that suitable accommodation for the necessary transformers and switchgear shall be provided by the consumer, which plant may also be used by the Corporation for supplying other consumers. The consumer is to have the option of bulking all requirements, whether for lighting, heating or power, and be charged on the above tariff.

ASSISTED WIRING SCHEME.—The Corporation Electricity Committee is to apply for sanction to a loan of £50,000 for the assisted wiring scheme.

Newcastle-on-Tyne.—ELECTRICITY CHARGES.—The *Yorkshire Post* reports that the cost of electricity in Newcastle and district, where the two supply companies charge 6d. per kWh for domestic supplies, was discussed at a meeting at Newcastle on January 2nd of a committee appointed from a joint conference of Tyneside authorities and representatives of the electricity companies. The meeting was private, and no official statement was made. It is understood, however, that the municipalities put their case for a reduction on the ground that various towns in the northern counties were able to obtain electricity at less than 6d. per kWh. The representatives of the companies, in reply, referred to the capital which had been sunk in their industry, on which there had not been an adequate return, owing to the depressed state of industry in the area. They also pointed out that the Newcastle Corporation supplied its own power for trams and street lighting. A promise was given that the companies would go into the matter, and a further meeting of the conference is to take place in a fortnight.

Newport.—ELECTRICITY SUPPLY.—The Borough Electrical Engineer has reported to the Electricity Committee that the new pumping station has been successfully put into commission, and that the execution of the contract is proceeding satisfactorily. He states that the frequency-lowering scheme has been completed and the Llanarth Street works was shut down on December 31st last as a steam generating station. The Electricity Commissioners have sanctioned £141,000 on account of mains and services, meters, &c.

Nottingham.—ELECTRICITY EXTENSIONS.—The Corporation Electricity Committee has decided upon further important extensions of electricity supply, and has recommended that application be made for sanction to borrow an additional £150,000, supplementing a loan of a similar amount granted in 1927, for a general extension of mains, for transformers and switchgear in connection with h.p. supply for outside service, the erection of sub-stations and meters and for work in relation to an assisted wiring scheme.

Plymouth.—MAINS EXTENSIONS.—The Corporation Electricity Committee, at its meeting on January 2nd, sanctioned mains extensions to a number of streets at an estimated cost of over £4,000.

Preston.—NEW PLANT.—The fourth generating set at the Ribble power station has been completed, although its final test has not been made. During December 7,000,000 kWh was generated, an increase of 60 per cent. over the corresponding month of last year. The number of consumers also showed an increase of 190. Formal sanction has been received to the borrowing of £3,500 for the purchase of property adjoining the works in Crown Street.

Sheffield.—MAINS EXTENSIONS.—The Corporation Electricity Committee has authorised mains extensions at a cost of £12,560.

Skipton.—YEAR'S WORKING.—The Urban District Council's electricity undertaking last year yielded a profit of £2,124, after providing for all charges, against a loss of nearly £1,000 in the three years 1924-6. The year's income was £7,786, and the number of consumers increased to 645. The returns presented to the Council show a fall in the consumption of gas of 5,000,000 cu. ft.

Special Order.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the Peacehaven Electric Light & Power Co., Ltd., to supply electricity in part of the parish of Piddinghoe.

Taunton.—ASSISTED WIRING SCHEME.—The Electricity Committee has presented a report to the Taunton Town Council on the question of free wiring, and the Council has accepted a recommendation that wiring for lighting only should be done by charging a slightly increased price for electricity extending over a period of three years.

Worcester.—LOANS.—The City Council is to institute a system of hire-purchase for wiring and to sell apparatus on direct cash or hire-purchase terms. Application is to be made for sanction to borrow £4,000 for assisted wiring work, and £4,000 for electric cookers, radiators, &c.

NEW SHOWROOMS.—The Council is to open showrooms for the display of electrical apparatus.

Worthing.—LOANS.—The Corporation has applied for sanction to loans of £8,405 for cables, and £2,500 for the purchase of additional cookers and heaters to be let out on hire.

York.—"ALL-ELECTRIC" HOUSES.—The Corporation Housing Committee has decided that the new houses to be erected in Burton Stone Lane shall be of the "all-electric" type.

Tramway and Railway Notes.

Argentina.—BUENOS AIRES.—According to the *Review of the River Plate*, the chairman of the Local Committee of the Buenos Aires Great Southern Railway has presented to the Ministry of Public Works the plans relative to the forthcoming electrification of the company's suburban services. Electric locomotives will be used, and it is expected that the first of these units will be available for trial shortly.

Burnley.—DOUBLING OF TRACK.—The Corporation is to double the tramway track between Gainsborough Avenue and Manchester Road summit terminus loop, at a cost of £1,500.

Continental.—FRANCE.—An amalgamation is being effected of the two Paris electric underground railways—the Metro and the Nord-Sud. The lines of the two concerns represent a length of about 97 miles, of which 70 miles is in operation. As a result of the amalgamation it is proposed to extend four of the principal lines in order to meet the requirements of people who are now living further out from the centre of Paris than before the war.

SWITZERLAND.—With the recent inauguration of an electric train service on the line between Zurich and Schaffhausen, the first schedule of the electrification of the Swiss Federal Railways has been completed. Out of a total length of nearly 1,840 miles, just over 1,000 miles is now electrified. The second schedule of work only provides for the electrification of 265 miles of line, and this is now in process of execution.

GERMANY.—Work is at present in hand on the construction of an electric railway from Eibsee to the summit of the Zugspitz, in the Bavarian Alps. In the first section of the 39-in. gauge railway from Garmisch to Obergrainau, the ordinary adhesion system is used, but from the latter place to Platt, 8,750 ft. above sea level, the line will be on the rack system, while the last 660 yards of the line will consist of an electrically-operated aerial ropeway. The entire length of the line will be 11¼ miles, of which about 3 miles will consist of tunnels at a height of about 5,000 ft. above the sea. The contract for the construction of the line, including the whole of the electrical equipment, is in the hands of the A.E.G., of Berlin.

BELGIUM.—The electrification work on the Anderlecht-Cité Bon Air section of the Société Nationale local railways has been completed, and an electric train service was inaugurated on December 23rd.

Hull.—TRANSPORT IMPROVEMENTS.—The general manager has submitted to the Corporation Tramways Committee a proposal for extending the Anlaby Road track along Boothferry Road for a distance of about 500 yards, at an estimated cost of roughly £6,000, which would enable a seven-minutes' service to be run. The Committee has decided that as a temporary measure the general manager shall arrange for a 'bus service to be run from the Newington level crossing to the Pickering Park tramway terminus, along Boothferry Road, to form a connecting link between the Hessle Road and Anlaby Road tram services.

London.—"UNDERGROUND" IMPROVEMENTS.—The Underground Electric Railway Companies have drawn up a programme of works to be carried out during the current year. Escalators are to be installed at Highgate and Camden Town stations, Ealing Common, Notting Hill Gate, and Hounslow West stations are to be rebuilt, and improvements are to be made at St. James' Park, Post Office, and Mansion House stations. New rolling stock to be put into commission will include 372 more cars on the Hampstead and City, Bakerloo and Piccadilly tubes, and 91 new motor-cars on the District Railway. Improvements at Lots Road power station will include the installation of a sixth 15,000-kW set, with new boilers and switchgear. On the tramway section two new model tramcars of modern type will be introduced, uncovered-top tramcars will be converted into "covered tops," and more cars on the South Metropolitan Electric Tramway will be remodelled on up-to-date lines.

Telegraph and Telephone Notes.

Argentina.—TELEPHONY.—The United River Plate Telephone Co. has at last obtained the necessary Government authorisation to lay an underground telephone cable between Buenos Aires and Rosario to replace the present overhead lines; it will be repeatered and loaded, and not be affected by atmospheric conditions. In accordance with the contract the cable must be completed within two years, and it is expected that the work will cost nearly £500,000. An Argentine company holding concessions in San Luis has applied for extended facilities, offering in exchange to link up San Luis with Mendoza and Buenos Aires. The company concerned is probably the Sociedad Anonima Andina, a comparatively small undertaking operating systems in Mercedes, San Luis, and elsewhere in the province of San Luis. *Reuter's* agency states that it has been decided to install a series of complete telephone circuits, partly subterranean and partly aerial multi-conductors, in the northern territory of Missiones. As much of the country is dense forest and tropical jungle the work will prove difficult. The installation will unite Posadas with several small villages, Concepción-del-Uruguay and St. Javier, and a number of adjacent townships.

Brazil.—RADIO-TELEGRAPHY.—Brazil and Peru signed a three-year radio-telegraph treaty on December 31st, 1928, by which a service will be established between the stations at Iquitos (Peru) and Cruceiro Desulk (Brazil).

Isle of Man.—TELEGRAPHY.—Submarine cable telegraph communication between the mainland and the island, which was interrupted on December 24th, 1928, was restored at 9 p.m. on January 2nd.

Russia.—PHOTOTELEGRAPHY.—Apparatus for the transmission of photographs by wireless has been received from Germany and installed in the Central Telegraph Office at Leningrad, to enable pictures and writing to be transmitted from Leningrad to Moscow by the telegraph wire and wireless systems.—*Reuter* (Leningrad).

Telephone Service.—BRITAIN'S POSITION.—It is estimated by the *Telephone and Telegraph Journal* that there were 32,500,000 telephones in use in all parts of the world at the end of 1928, an increase of almost 1,500,000 on the figures for 1927. North America, with approximately 20,000,000 telephones, leads the world, Europe occupying second place with over 8,500,000. The number of telephones per 100 inhabitants in the principal telephone-using countries is:—

United States	16	Germany	4.4
Canada	12.7	Great Britain	3.6
New Zealand	9.9	Netherlands	3.2
Denmark	9.2	Finland	3.1
Sweden	7.6	Austria	2.4
Australia	7.4	Belgium	2.4
Norway	6.3	France	2.1
Switzerland	5.5	Argentina	2.1

Great Britain is thus tenth on the list, but there was an increase of 122,217 telephones in this country during 1927, only 4,000 below the increase in Germany, and much greater than the growth in any other European country. The total number of telephones in Great Britain on December 31st was 1,633,802.

AUTOMATIC AINSDALE EXCHANGE.—Another stage in the automatic telephoning of the Southport area was completed by the cut-over on December 15th of Ainsdale to the Southport multi-office network. The installation of the Strowger equipment has been carried out by the Automatic Telephone Manufacturing Co., Ltd., the contractors for the original installations at Southport main exchange, Churchtown, and Birkdale. The new exchange is a satellite to the Southport main exchange, the system being four and five digit with booster-battery metering. The switchroom contains eight rotary lineswitch units; a composite trunk board, which carries the switching selector repeaters and group selectors; a 3-bay meter rack; a traffic-meter rack, mounting congestion, overflow, total traffic, and traffic unit meters; a repeater rack, and a rack for outgoing secondary line switches. All the supervisory alarms terminate at the supervisory rack, and provision is made for classifying them under one of two grades of urgency by means of straps on a tag-block. Facilities are also provided for extending the supervisory circuits to Southport so that Ainsdale can be supervised from that point during slack periods. The present capacity of the Ainsdale automatic exchange is 800 lines, with provision for ultimate extension to 1,300 lines.

Radio Notes.

Australia.—ROYALTIES.—An agreement has been reached between the Commonwealth Government and Amalgamated Wireless (Australasia), Ltd., that the company's patent rights shall be made available free of charge to all wireless trade broadcasting companies and listeners for a period of five years, dating from November, 1927. To carry out the arrangement the company has made heavy sacrifices, says the *Wireless World*, including an estimated sum of £62,500 on listeners' licences and a similar amount on valve royalties, in consideration of which the company will receive from the Government 3d. per month, or an average of 3s. per annum, in respect of every receiving licence issued. On a basis of 250,000 licences, the amount received by the company will be £37,500, or £88,000 less than was originally claimed.

British Broadcasting.—1928 ACCOMPLISHMENTS.—Apart from programme features, a review of the British Broadcasting Corporation's achievements during the past year shows that one of the most outstanding was the start made in May with the erection of the new regional transmitter at Brookman's Park, which twin wavelength high-power station for serving London is intended to be the first of its kind in the world; it is to be ready next summer, and ultimately will give to all South-East

England an alternative programme, and several sites were being examined in other parts of Britain with a view to the erection of similar stations. After several months' experiment, a new aerial was put into service at the Daventry experimental station (5 GB) in January, with the result that the quality of reception in the north, north-east, and south of England was distinctly improved. "Outside broadcasts" which owed their success largely to engineering skill included the relay of a nightingale's song from Pangbourne in May, reception reports being received from as far afield as New Zealand; the relay of a running commentary on the University boat race in March with the aid of a floating transmitter; with telephone land lines and submarine cable relays from Belgium and Germany in March, and from France in August; and with a short-wave transatlantic radio link from America in July and October.

The Kent Report in July and an Interim Committee for Schools Broadcasting prepared the way for the formation of a Central Council for Schools Broadcasting, which will come into existence early in 1929 and supersede the old Education Advisory Committee on the schools' side; the Kent Education Committee decided to regularly subsidise its schools for wireless reception. Receiving sets were installed in a number of reformatory and industrial schools under the Home Office, and the London County Council relaxed its restrictions of the hours in which the schools under its direction may listen. Some of the recommendations of the Hadow Committee were already in process of being carried out, and the Central Council for Broadcast Adult Education, under the chairmanship of Lord Justice Sankey, held its first meeting on November 8th. The number of listening groups increased from 60 to 160, and experiments in broadcast adult education were initiated in prisons, in the R.A.F., and in the British Legion, while sanction was given by the War Office for similar experiments in the Army.

The first transmission of "still" pictures took place in October. Pending the introduction of the regional scheme, rather than withdraw the relay stations, an attempt was made to overcome interference and revive their usefulness by the expedient of single-wave working; as a step towards the development of regional programmes, the Nottingham transmitter was taken out of service in November, and Nottingham listeners have since taken their place along with Birmingham listeners in the service area of Daventry (5 GB). A system of group programmes was also developed, material for the projected regional centres (Manchester, Glasgow and Cardiff) being contributed by the various stations within the regional areas. During the year an aggregate of 68,000 hours comprised the programme transmissions from the twenty-one stations of the B.B.C., and the total period of breakdown was less than twenty hours. The licences in force at November 30th numbered 2,580,342, including 13,826 free licences issued to blind persons.

Canada.—STATIONS.—The Minister of Marine has licensed 68 broadcasting stations, 32 of which provide intermittent services at low power and of purely local interest. Some 60 per cent. of the receiving sets in use are classed as urban and 40 per cent. as rural.

Fultography.—B.B.C. SERVICE.—The British Broadcasting Corporation announces that an agreement has been arrived at between it and Wireless Pictures (1928), Ltd., under which the company will continue to transmit pictures by wireless until October 30th, 1929, instead of ceasing at the end of 1928.

TALKING KINEMATOGRAPHY.—Talking films for the home and the reception of still photographs on the same apparatus are made possible, it is claimed, by an invention of Mr. G. V. Dowding, which *The Times* understands is shortly to be demonstrated to the B.B.C. A projector is run at the broadcasting station, and synchronisation of all the listeners' projectors is achieved in an extremely simple manner. At the broadcasting station the play is spoken by artists watching the film, and effects and music are arranged in a similar manner.

North Africa.—TUNIS STATION.—It is understood by *World-Radio* that the 10-kW transmitter constructed near the old town of Carthage, 50 km. from Tunis, will soon commence operation on a wavelength between 300 and 400 m. It is connected by means of a special land line with the studio, which is in Tunis itself. Tests on a wavelength of 1,825 m. were recently carried out.

United States.—MONOPOLY DISPUTE.—A dispute which has been exercising the American radio industry for some time has been won by the General Electric, Radio Corporation, American Telephone and Telegraph, the Western Electric, the Westinghouse Electric, the International Radio Telegraph and the United Fruit and Wireless Specialities Apparatus Companies, whose opponents are the Radio Protective Association, representing independent concerns, which claims that the firms mentioned are monopolising the manufacture and sale of radio equipment. The Federal Trade Commission has dismissed the complaint, deciding that it is without jurisdiction to prosecute The *Wireless World* reports that the Radio Protective Association will resume the attack by pressing the Department of Justice to take the case into Court.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—NEW SOUTH WALES.—February 11th. Department of Public Works. Supply, delivery, erection and maintenance of hydro-electric plant in connection with the Hume Reservoir hydro-electric development. (B.X. 4989.)*

January 21st. Static transformers for Young-Wyangala section of the Burrinjuck hydro-electric development. (B.X. 4995.)

Belfast.—January 29th. Public Health Committee. Installation of automatic telephones in the Infectious Diseases Hospital, Purdysburn. (See this issue.)

Belgium.—January 22nd. Municipal authorities of Saint Gilles, Brussels. 400 3-amp., 220-V and 1,600 5-amp., 222-V ampere-hour meters. Particulars (5 francs) from Service de l'Electricité, Hotel Communal, Saint Gilles.

Brentford.—BOARD OF GUARDIANS.—Installation of electric lift at the West Middlesex Hospital, Isleworth. (January 4th.)

Edinburgh.—January 18th. District Board of Control. Electric power and lighting installation at Gogarburn, Edinburgh. Specifications from Mr. Stewart Kaye, architect, 14, Hill Street, Edinburgh.

Egypt.—CAIRO.—January 31st. Ministry of the Interior. January 27th. Transformer kiosks, cables and accessories for the extension of electricity supply from Mit-Ghamr power station. (B.X. 4893.)*

Glass Houghton (Yorks.).—January 14th. West Riding Education Committee. Electric lighting installation at Ashton Road Council school and caretaker's house. Specifications, &c., from Education Department, County Hall, Wakefield.

India.—January 23rd. Bombay, Baroda, and Central India Railway Co. 400-kW heavy oil engine driven generating set. Specifications from the offices, White Mansion, 61, Petty France, S.W.1 (deposit £1). (January 4th.)

February 5th. Turbo-alternator set, condenser, boiler, economiser, switchgear and cables for the new power station, Delhi. (B.X. 4944.)*

Keighley.—January 17th. Electricity Department. One water-tube boiler (30,000 lb. per hour) with mechanical stoker and superheater. (December 28th.)

Kettering.—January 14th. Electricity Department. Supply and delivery of h.p. and l.p. cables, and transformers. (January 4th.)

Liverpool.—January 31st. Corporation. Supply of various electrical materials. (January 4th.)

London.—CENTRAL ELECTRICITY BOARD.—February 15th 66,000-V cables (London area) in connection with the South-East England Electricity Scheme. (See this issue.)

February 18th. Supply, delivery and erection of 132,000-V overhead transmission lines in connection with the Central England and North-West England and North Wales Electricity Schemes. (January 4th.)

February 22nd. 132-kV outdoor switchgear for the transforming stations in the Central England Electricity Scheme area, 132,000-V transformers. (See this issue.)

Newry.—January 25th. Urban District Council. Supply of single- and three-phase meters. (See this issue.)

New Zealand.—WELLINGTON.—February 12th. Posts and Telegraph Department. Dry cells for telephone work. (B.X. 4991.)*

February 28th. Telephone cordage. (B.X. 4990.)*

January 31st. Manawatu-Orona Electric Power Board. Automatic reclosing switchgear for pole platform mounting. (B.X. 4988.)*

Norton.—January 14th. West Riding Education Committee. Electric lighting installation at the new school. Specifications, &c., from Education Department, County Hall, Wakefield.

Ripon.—February 1st. Corporation. Works in connection with the proposed electricity supply undertaking as follows:—Contract No. 2: Overhead 11,000-V transmission line. (January 4th.)

Sheffield.—February 14th. Electricity Supply Department. Turbo-alternator, condensing plant, evaporating and steam preheating plant, water-tube boilers, chimneys, superheaters, stokers, or pulverised fuel firing equipment, economisers, &c., wagon tippers, conveyors and elevators, cooling towers, electrically and hand-operated travelling cranes. (See this issue.)

South Africa.—JOHANNESBURG.—January 24th. Town Council. Electric cable. (B.X. 4977.)* Oil switches. (B.X. 4994.)*

CAPE TOWN.—January 23rd. City Council. Electric cable. (B.X. 4978.)*

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Birmingham.—The Corporation Electric Supply Committee reports that in connection with the erection of Hams Hall power station, a contract for which was entered into with International Combustion, Ltd., in July, 1927, all sub-contractors have to be approved, and the chief of these are as follows:—

Electrical equipment of the station, including the steam turbines.—General Electric Co., Ltd.
Condensing plant.—Hick, Hargreaves & Co., Ltd.
Boiler plant.—Babcock & Wilcox, Ltd.
Foundations, buildings, ferro-concrete cooling towers, all civil engineering work, and the coal and ash handling plant.—Mitchell Conveyor & Transporter Co., Ltd.
Structural steelwork of the buildings.—Braithwaite & Co. (Engineers), Ltd.

Chelmsford.—Town Council. Accepted:—
Electric fire-alarm system (£280).—Carter & Co.

Cheltenham.—Electricity Committee. Recommended:—
Rewinding remainder of motors in connection with change-over scheme.—Brook Motors, Ltd.

Colchester.—Electricity Committee. Accepted:—
Supply, delivery and laying or erection of underground and overhead cables and supports, &c. (£3,779).—W. T. Henley's Telegraph Works Co., Ltd.

Earby.—Urban District Council. Accepted:—
Electric wiring of Council offices and adjoining house (£70).—A. Dodgson & Son.

Liverpool.—BOOTH STEAMSHIP CO., LTD.
Contract for 12 months' supply of electric lamps.—Siemens Electric Lamps & Supplies, Ltd.
Tramways Electric Power and Lighting Committee. Recommended:—
Six 500-kVA transformers (£1,344).—General Electric Co., Ltd.
450 pairs fishplates.—Titan Trackwork Co., Ltd.

Reigate.—Town Council. Accepted:—
Wiring small houses under the hire-purchase scheme for 12 months.—T. S. Marriage & Co.

Salford.—Electricity Committee. Recommended:—
Two 1,500-kVA step-down transformers for Agecroft power station (£1,528).—Metropolitan-Vickers Electrical Co., Ltd.; and one 1,000-kVA ditto (£474).—General Electric Co., Ltd.
Merz-Price gear for 1,500-kVA auxiliary transformer (£75); 6,600-V banking cubicle on No. 4 alternator terminals (£140); 33,000-V banking isolators for the 12,000-kVA step-up transformers (£90).—Metropolitan-Vickers Electrical Co., Ltd.

Worthing.—Corporation. Accepted:—
Provision and laying of e.h.p. cable and distributing cables (£8,405).—Callender's Cable & Construction Co., Ltd.

York.—Electricity Committee. Recommended:—
Cable (£4,770).—Callender's Cable & Construction Co., Ltd.

Forthcoming Events.

Junior Institution of Engineers.—Friday, January 18th. 39, Victoria Street, S.W. 7.30 p.m. "Notes on the Fitting and Operation of Michell Bearings." Mr. J. F. Petree.

Chemical Engineering Group.—Friday, January 11th. Royal Society of Arts, Adelphi, W.C. 8 p.m. "The Relative Safeties of Mild and High Tensile Alloyed Steels under Alternating and Pulsating Stresses." Prof. B. P. Haigh.

Institution of Electrical Engineers.—INFORMAL MEETING.—Monday, January 14th. Institution, London, W.C. 7 p.m. Discussion on "Electric Trolley Omnibuses."

(Western Centre).—Monday, January 14th. Grand Hotel, Bristol. 6.30 p.m. for 7 p.m. Annual dinner.

(North Midland Centre).—Tuesday, January 15th. Hotel Metropole, Leeds. 7 p.m. "Recent Developments in Electricity Meters, with particular reference to those for special purposes." Mr. J. L. Carr.

(East Midland Sub-Centre).—Tuesday, January 15th. Technical College, Derby. 6.45 p.m. "Practice and Progress in Combustion of Coal as Applied to Steam Generation." Mr. F. H. Rosencrants.

(Sheffield Sub-Centre).—Wednesday, January 16th. Royal Victoria Hotel, Sheffield. 7.30 p.m. "The Electrical Engineer and Medical Science." T. W. Sampson.

(North-Eastern Centre).—Monday, January 14th. Armstrong College, Newcastle-on-Tyne. 7 p.m. General discussion on "The Anticipation of Demand and the Economic Selection, Provision, and Lay-out of Plant." Introductory papers: Capt. J. M. Donaldson, M.C. (power systems), and Mr. J. G. Hines (telephone systems).

(Tees-Side Sub-Centre).—Wednesday, January 16th. Cleveland Technical Institute, Middlesbrough. 7 p.m. Informal discussion: "The I.E.E. Wiring Regulations," opened by Messrs. S. G. Marston and D. G. F. Drummond.

Electrical Society of Glasgow.—Tuesday, January 15th. Reid's Smoke Room, Glasgow. 7.30 p.m. "Notes on Electrical Maintenance." Mr. W. Macfarlane.

Institute of Fuel.—Wednesday, January 16th. Chemical Society's Rooms. 6 p.m. "Continental Experience in Pulverised Fuel Practice." Messrs. Berg and Vogt.

Overhead Lines Association.—Wednesday, January 16th. Institution of Electrical Engineers, London, W.C. 5.30 p.m. "British Climate and Overhead Lines."

Institution of Civil Engineers.—INFORMAL MEETING.—Wednesday, January 16th. At the Institution, Great George Street, S.W.1. 6 p.m. "Merits and Demerits of Alternative Methods of Taking Water for Modern Power Stations from Tidal Waters." Mr. H. H. Dalrymple-Hay.

Royal Society of Arts.—Wednesday, January 16th. John Street, Adelphi, W.C. 8 p.m. "The Domestic Smoke Problem: A Practical Solution." Prof. C. R. Darling.

Royal Institution of Great Britain.—Friday, January 18th. At the Institution, W.1. 9 p.m. "Further Progress in Crystal Analysis." Sir William Bragg.

British Electrical Development Association, Inc.—Friday, January 18th. Royal Society of Arts, Adelphi, W.C. 7.30 p.m. "Electric Heating and Cooking Development."

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

SANS wash boiler.
LUCETTE fittings.
AJAX insulated staples.
ROCHESTER electric coffee pot.

Notes.

Inspiration.

Mr. Theodore Stevens, M.Inst.C.E., writes:—Last Saturday *Reuter's Service* gave Europe the information that the residue of the estate of the "Father of Aluminium," Charles M. Hall, amounting to two millions sterling, had been allocated to Indian and Chinese education foundations, including America College, Madura, and Allahabad Agricultural Institute, Oberlin Shansi Memorial Association, Harvard Yenching Institute, Lingman University, Fukien Christian University, West China Union University, Nanking University, and Shantung University.

As a personal friend of C. M. Hall, having worked with him on this development, it seems to me of value to record, as an inspiration to others, some little idea of what started him on making, not only millions for himself, but also employment for thousands in many parts of the world. His own share in the profits, in my estimation, was modest. Wickham Steed, in "Through Thirty Years" (1922), wrote: "Notable results have been accomplished through the agency of such unimportances." C. M. Hall was the son of a devout preacher, who brought up his family on a meagre income, but he managed to send this son to Oberlin College, Ohio. The Professor of Chemistry showed to his class, in an issue of the *Chemical Journal* (London), a list of unsolved

chemical problems, and with the question: "Which of you will undertake to solve one of these problems?" inspired C. M. Hall, who, on reading that list and feeling uncertain which to tackle, decided on the first. On what little he could find in the college library he took his chance and patented, as was possible at that time, the extraction of aluminium from its fluorides, his reason being that fluorides were the only combination not the subject of an existing patent. He spent all the money he could borrow on experiments and separated pin-points of metal, using current from the crudest primary batteries.

His father besought him to get an honest clerkship and stop wasting other people's money; but perseverance led to success as soon as adequate power was available and large-scale work was undertaken.

The company of which he was the founder started with natural gas in Pittsburgh in 1889, originated the Niagara Falls power demand by contracting for the total output of the first of the 5,000-h.p. sets put to work in 1893, bought up the "hydraulic company" which had been playing from 1853 with small, low-head plants in a canal around the upper Niagara rapids, enlarged that canal, and utilised the full head; it next developed Shawinigan, a wilderness, where to-day nearly fifteen thousand people are living on a waterfall whose ancient beauties were known to only an occasional hunter. Other water-powers in the United States and Norway were utilised, and to-day the aluminium industry is a vast success. He made reasonable provision for his relations, and the residue was allocated for the benefit of others.

Fatality.

While working with an electrically-operated fan in the Blantyreferme Pit, Newton, near Glasgow, on January 5th, one man received a shock which proved fatal and another was injured.

The Development of an Electric Tractor.

At a meeting of the Highland and Agricultural Society of Scotland, at Edinburgh, a letter was read from Major A. McDowall, Mungoswells, Drem, East Lothian, regarding the development of an electric tractor. Major McDowall stated that the Development Commissioners were keenly interested in the tillage problem, and that the drawings of his latest electric tractor had been approved by a member of the Development Commission. The latter was ready to make grants to a society, such as the Highland, whose duty it would be to apportion the money on machinery and incidental expenses. Major McDowall thought that about £3,000 would be required to carry out the experiments, and urged the Society to apply to the Board of Agriculture for Scotland, through which the money would have to come. After a discussion, in which it was said the scheme must be wide enough to include all electric tractors, and could not be confined to one machine, it was decided to refer the matter to the Implement Committee for a report.—*Implement and Machinery Review.*

Electrical Circuit Breaking.

In the abstract of the I.E.E. paper of Messrs. Wedmore, Whitney, and Bruce, in our issue of December 28th, the first sentence in the third paragraph on page 1133, as it stands, may give the impression that it is the authors' view that "the whole of that part of the (arc) voltage which depends on the length of the arc depends also on the current in the arc." This is, of course, not the case; reference to the original will show that the authors were, in the part referred to, emphasising an aspect of the formulæ of Steinmetz and Norberg. We are informed that a slip occurred in the original paper, where, in the definition of e_1 in the list of symbols given on page 2, the sign "=" should be replaced by "approximately equal to," since from the point of view of energy calculation, as was pointed out in the paper, the term $kl/\sqrt{i}$ in the arc characteristic can be neglected.

Coal Treatment.

The following notes are taken from a paper, "The Future of Coal in Relation to Industry," by Lt.-Col. J. T. C. Moore-Brabazon, M.C., read recently before the Junior Institution of Engineers:—Low-temperature carbonisation has the great advantage that the non-coking coals can be treated even more easily than strongly coking coals. The coal is turned into three main commodities: residual fuel, oil, and gas, each of which is more marketable than the original fuel. The proportions of these vary enormously according to the type of coal used, but representative figures per ton of coal treated are 13-14 cwt. of residual fuel, 3,000 cu. ft. of gas at a B.th.u. value of about 750, and 20 gallons of oil. While coke has a strongly graphitic covering due to the oil cracking which takes place around it at the temperatures involved in its manufacture, residual fuel from low-temperature carbonisation is of an entirely different type, for the structure of the coal is maintained in its original form; its oil content has been extracted, and it has no graphitic covering; it has about 10 per cent. of volatile matter, the rest being carbon and ash. This fuel is readily lit, will burn in an open fire lit by paper (not even demanding wood), and, unlike coke, will burn itself out. Oil from coal contains about 15 per cent. of most valuable lubricating oils, and when it is remembered that in this highly industrial country of ours 98 per cent. of the lubricating oil used is imported from America, it will be realised that the production of lubricating oil from any home source is a very desirable thing.

The advent of pulverised fuel introduces a method of burning coal in a much more efficient way. Residual fuel is eminently suitable, if pulverised, for consumption beneath boilers. Most of the volatile content having been taken out, it is a non-explosive fuel, and, consequently, the future storage in large tanks of this particular fuel is well within sight. It is not pretended that the technical difficulties of the use of pulverised residual fuel in large quantities are at the present moment solved, but the solution is within sight. Such necessities as keeping the powder what is called "fluffed," or in circulation, with inert gas derived from the smoke stack, in order to stop the fuel packing and keeping it always in a fluid state, are problems for the engineer in the immediate future; but what should be stressed more than anything is that here is an actual new field for the consumption of coal. Further, the position which has almost been accepted to-day, that future transport upon the sea will not be coal-driven, has to be strongly fought, and when it comes down—as it must come down—to a fight to a finish between oil and coal as a prime mover of ships, powdered fuel must, due to its economy—and it is economy which will decide the fight—win in the end.

Safety in Mines Research Board.

The Secretary for Mines announces changes in the constitution of the Safety in Mines Research Board. Sir Thomas Mottram, C.B.E., Sir Richard Redmayne, K.C.B., and the Rt. Hon. Thomas Richards retired at the end of the year on the completion of their period of office, but as Sir Thomas Mottram is actively engaged in an extensive and difficult investigation into the methods of reducing accidents from falls of ground, he has been re-appointed for a period of two years.

New Magnetic Alloys.

New magnetic materials known as "Perminvars" have been developed at the Bell Telephone Laboratories, Inc. Several of these alloys have extraordinary magnetic properties, which are particularly suited for uses in electrical communication circuits. An example is one containing 45 per cent. nickel, 25 per cent. cobalt, and 30 per cent. iron, which has besides other unusual magnetic qualities a high initial permeability. The properties of the Perminvars are developed entirely by heat-treatment. The alloys are heated at 1,000 deg. C. for a short time and then cooled; the rate of cooling from 600 to 400 deg. C. determines the degree to which these properties are developed. The best results are obtained when the rate is such that it takes about five hours to cool through this temperature range. Above 600 deg. and below 400 deg. C. any convenient rate of cooling may be used, but it must not be so rapid that strains are set up in the alloy.

For magnetising forces below 1.7 gauss, the permeability of the alloy mentioned is substantially constant. This constancy is remarkable for a magnetic material having an initial permeability approaching 500, and therefore nearly double that of iron. Another property of the Perminvars is the extremely small hysteresis loss in the range of magnetising forces and flux densities in which the permeability is constant. It is noteworthy that while silicon steel and "Armco" iron both have considerable areas within the hysteresis loop, it has been shown that the hysteresis losses for the Perminvars are very minute, and that they are less than that for Permalloy.—*Bell Laboratories Record.*

The Channel Tunnel.

A strong movement is on foot with a view to reopening the question whether sanction can be obtained from Parliament for the construction of a tunnel under the Straits of Dover; Sir William Bull, M.P., has addressed a letter to members of both Houses inviting an expression of their views on the subject. The project was last considered by the Committee of Imperial Defence in 1924, and was rejected on the ground that it was a dangerous experiment.

Electricity Supply in North-West England.

It is reported that the Central Electricity Board's plans for the north-west area allot to the power station of the Carlisle Corporation an area extending from the Border to North Lancashire. The main transmission lines will run from Carlisle over Shap Fell to Kendal, Lancaster, and Preston, with a connection to the mining district of West Cumberland. Transforming stations will be situated at Penrith, Keswitch, Whitehaven, Cleator, and Egremont.

Appointments Vacant.

Motors and hiring superintendent (£308) for the Birkenhead Corporation Electricity Department. Junior charge engineer for the City of Portsmouth Electricity Department. Wiremen (£400) for the Government of Nigeria P.W.D. Electrical Branch. Three junior charge engineers for Bristol Corporation Electricity Department. Electrical engineer for power station in Calcutta (commencing Rs. 640 monthly) for the Calcutta Electric Supply Corporation, Ltd. (See our advertisement pages to-day.)

Institution Notes.

Institute of Fuel.

The meeting which was to have been held on Wednesday last has been postponed until Wednesday, January 16th. The paper which Mr. H. A. S. Gothard was to have presented unavoidably had to be cancelled. In place of it a paper entitled "Continental Experience in Pulverised Fuel Practice" will be presented by Mr. Berg and Mr. Erich Vogt, of Cologne, in the rooms of the Chemical Society, Piccadilly, London, W.1. The chair will be taken at 6 o'clock by Dr. R. Lessing, F.I.C., F.Inst.F., and a general discussion will follow the reading of the paper.

Illuminating Engineering Society.

The twentieth anniversary dinner of the Illuminating Engineering Society will be held at the Trocadero Restaurant, London, on Wednesday, February 13th, at 7 for 7.30 p.m., when the President (Mr. C. C. Paterson, O.B.E.) will occupy the chair. At the conclusion of the dinner a hall will be available for dancing.

Junior Institution of Engineers.

ANNUAL DANCE.—Tickets are now available for the annual dance, price 6s. 6d. each, which is to be held at the Portman Rooms, Baker Street, London, W., on February 23rd.

CONTINENTAL EXCURSION.—A very attractive summer excursion in Belgium and Germany is being planned; ladies will be welcomed. The party will depart from London on Friday evening, June 21st, and arrive back early on Monday morning, July 1st. The cost per head should not exceed £17 10s., excluding that of passports, and members who are likely to participate should notify the secretary of their intentions at once.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. PERCY STILL's resignation of the honorary secretaryship of the Diesel Engine Users' Association, after fifteen years' service with the organisation, took effect on December 31st. On that day the Association changed its address to its new headquarters (307, Abbey House, Westminster, S.W.1). Engineer-Captain J. HOPE HARRISON, R.N., who has been greatly interested in the Association's affairs, succeeds Mr. Still as honorary secretary, and he will have the assistance of Mr. C. O. MILTON, who has been Mr. Still's co-honorary secretary for the past two years. Mr. G. T. GREENLAND is relinquishing the office of assistant secretary. Mr. F. A. GREEN is the new honorary treasurer.

In succession to Mr. John Aldworth, who retired recently after holding the position for nearly 30 years, Mr. W. G. MARKS, who, until his appointment, had occupied a similar office at Chesterfield, entered upon his duties at the beginning of the New Year as general manager of the Nottingham Corporation tramway and 'bus undertakings. Mr. Aldworth has consented to serve in an advisory capacity.

Mr. STANLEY CECIL DAVIES and Miss ELSIE STEEL, who have been on the staff of the Hewittic Electric Co., Ltd., of Hersham, have been presented on their marriage with a cabinet of cutlery and other gifts by their colleagues.

Prof. E. F. PETRITSCH, who for some years has been the chief engineer of the Pupin coil section of the Dutch State Telegraphs at The Hague, has been appointed professor of the recently-formed department of electrical long-distance communication in the Technical High School of Vienna. It was in the same school of which he is now a professor that he received his early training, later entering the Austrian State Telegraph Department.

The *Electrical Power Engineer* mentions in its December issue a case of gallantry on the part of one of its members, Mr. L. FLATHER, charge engineer, on the occasion of a breakdown at the Carlisle generating station. A 2,000-kW turbo-generator set, on the point of being shut down, suddenly set up violent vibration and proceeded to shed its tachometer and sundry other accessories. At great personal risk Mr. Flather rushed to shut off the steam as the main centre bearing of the machine parted company, and it was only his prompt action and that of his driver which saved valuable machinery in the vicinity from serious damage. In recognition of his prompt action and devotion to duty, the Carlisle Electricity Committee, through the city electrical engineer (Mr. C. W. Salt), presented Mr. Flather with a set of drawing instruments, and his driver with a silver cigarette case.

Mr. NICHOLAS F. DODDS, test superintendent in the Telegraph Department of the General Post Office, Edinburgh, has retired under the age limit.

Councillor W. J. PERRETT has been appointed chairman of the newly-constituted Light Railways and Transport Committee of the Southend Corporation, it having been decided to separate the undertaking into two distinct departments.

The Dover Town Council has appointed Mr. R. BOURN, from the Meter Testing Department, to be shift engineer at the electricity works for a year on probation. There were 55 applicants for the post.

The Barrow Electricity Committee recommends that the salary of Mr. H. R. BURNETT, the borough electrical engineer, be increased from £800 to £950 per annum.

Consequent upon his appoint nent as district engineer for the North-West England and North Wales Electricity Scheme, Mr. R. BLACKMORE will resign as technical adviser to Nelson and other authorities. Mr. NAYLER was recommended as his successor at Nelson, and the Electricity Committee is to consider the matter and that of the general control of the department.

Hammersmith Borough Council Establishment Committee recommends that Mr. G. A. TOTTMAN, engineer-in-charge at the Electricity Department, be promoted to the position of repairs engineer, at a salary of £399 per annum; and that Mr. D. D. EVANS, junior engineer-in-charge, be promoted to the position of engineer-in-charge, at a salary of £363 per annum.

Major F. J. CHAPPLE, who has lately resigned the general managership of the Yorkshire (Woollen District) Electric Tramways Co. to take over the general management of a big motor-'bus undertaking with headquarters at Harrogate, was on December 31st presented with a bookcase, dinner wagon, and a timepiece by the employés of the company at Dewsbury headquarters.

Mr. E. BELL, of the St. Helens Corporation tramways, has been appointed general manager of the Yorkshire (Woollen District) Electric Tramways Co. in succession to Major Chapple.

Obituary.—MR. S. P. W. V. LUKE.—The death occurred at Newbury, on January 1st, in his 84th year, of Mr. Stephen Paget Walter Vyvyan Luke, C.I.E. He entered the Indian Telegraph Department as long ago as 1868, and after important service, including field campaigning in Afghanistan, he was in 1890 appointed Director of the Construction Branch of the Indian Telegraph Service, being promoted five years later to be Deputy-Director General, and retiring in 1897. Mr. Luke was a director of the Telegraph Construction & Maintenance Co., Ltd., and chairman of the Calcutta Electric Supply Corporation.

MR. J. FERGUSON.—We regret to learn that the death occurred on January 2nd, at Wimbledon, of Mr. John Ferguson, M.B.E., general manager of the Perak River Hydro-Electric Co., Ltd. He was only 42 years of age, and leaves a widow and three children. *The Times* states that Mr. Ferguson was born in Scotland, and after serving an apprenticeship, became assistant engineer in the Hamilton undertaking of Edmundson's Electricity Corporation, Ltd. After further experience on the Clyde, he went to Burma as electrical engineer to the Burma Oil Co., and later became electrical and mechanical engineer to the Patiala State Government. During the war he was attached to the air forces, and did useful work in the organisation of wireless telegraphy and telephony in the air defence of London. After the war he was appointed deputy chief electrical engineer to the East Indian Railway, and acted as chief electrical engineer for three years. He served on a special mission for the Government of India to reorganise the electrical department of the North-Western Railway of India, and soon after was appointed general manager to the Perak River Hydro-Electric Co. At the recent annual meeting of the company, the chairman (Viscount Elibank) referred to the fact that Mr. Ferguson had been compelled by ill-health to return home from the Federated Malay States, and said that the success which had attended the commencement of the company's work in Malaya was largely due to Mr. Ferguson's strenuous efforts. Viscount Elibank also mentioned that Mr. A. H. Topham, who had been in charge of all the electrical construction work for the past year, had been appointed to act as general manager in Mr. Ferguson's absence. Mr. Ferguson was a member of the Institutions of Electrical and Mechanical Engineers. A memorial service was held at St. Columba's, Pont Street, on Monday last. Viscount Elibank and other directors of the Perak River Company attended, as well as a number of representatives of electrical companies and consulting engineers. The interment was to take place in Scotland.

SIG. R. DEMARTINIS.—The death recently occurred in Milan, at the early age of 45 years, of Signor Rodolfo Demartinis, a well-known Italian electrical engineer, who had been associated with the electrification of several lines of railway, notably the Bolzano-Brenner line.

SIR H. TRUEMAN WOOD.—We have to record the death, at the age of 83 years, of Sir Henry Trueman Wood, who was secretary of the Society of Arts from the year 1879 to 1917. He had been assistant secretary from 1876 to 1879. In 1918 he became treasurer, and in 1919 chairman of the Council. He had been president of the Society, was editor of its *Journal* from 1872, and wrote a history of the Society in 1913. Among many other services rendered to Science and Art during his lengthy career may be mentioned the honorary secretaryship of the Mechanical Science (subsequently "Engineering") Section of the British Association.

HERR O. BONDY.—The death is reported from Vienna, at the age of 83 years, of Herr Otto Bondy, one of the pioneers of electric cable manufacture in Austria and Hungary.

MR. E. S. AMES.—The death took place on January 1st, after four days' illness, of Mr. Edward Simon Ames. Mr. Ames, who was 56 years of age, was in the employ of the Bradford Corporation electricity department for about 26 years, and for over 20 years was the chief motor inspector. The funeral took place at Bowling Cemetery on January 5th, and was attended by over 30 members of the staff of the Department.

MR. F. G. HOLDEN.—We regret to record the death, which occurred in London on Friday last, of Mr. F. G. Holden, formerly manager of the Scarborough Electric Supply Co. When the company's business was taken over by the Corporation he was appointed borough electrical engineer. He retired from that position last March, but continued as consulting engineer. He was with the company for over 30 years.

MR. E. C. FLINT.—We regret to record that Mr. Edwin Charles Flint, who had been for many years connected with the electrical trade, with Messrs. Siemens and other well-known companies, died on January 3rd after several months' illness.

Will.—The late Dr. R. KNOX, editor of the *British Journal of Radiology*, left £4,759 gross and £3,904 net personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Gee Jay Supplies (Wholesale), Ltd.—Private company. Registered December 29th. Capital, £1,000 in 10s. shares. Objects:—To carry on the business of electrical, wireless, mechanical and general engineers and engineering contractors, manufacturers of, and dealers in radio and telephone apparatus and supplies, wireless service agents, &c. The first directors are:—H. H. Holloway, "The Hetlands," Holway Road, Holywell, electrical and mechanical engineer (permanent managing director); F. T. Neal, "The Villa," Pantasaph, near Holywell, land steward. Solicitor: C. Jones, Vron Chambers, Holywell, Flint.

H. J. Electrical Services, Ltd.—Private company. Registered December 29th. Capital, £1,000 in £1 shares. Objects:—To acquire the business of an electrical service agent and automobile electrical specialist heretofore carried on by F. Hargreaves at 2, Bedford Street North, Halifax. The directors are:—F. Hargreaves (managing director), 2, Bedford Street North, Halifax; W. A. Bradley, "Braeside," Highroad Well, Halifax. Registered office: 27, Harrison Road, Halifax.

Caledonian Wireless Colleges, Ltd.—Private company. Registered in Edinburgh on December 28th. Capital, £2,000 in 4,000 preference and 4,000 ordinary shares of 5s. each. Objects:—To carry on business as indicated by the title. The directors are:—J. H. Semple, 51, Cairns Road, Cambuslang, electrical engineer; J. Maxwell, 33, Howishill Road, Kirkhill, Cambuslang, spice merchant. Secretary: J. H. Semple. Registered office: 24, India Street, Glasgow, C.2.

City Electrical Engineering Co. (Hull), Ltd.—Private company. Registered December 31st. Capital, £2,500 in £1 shares. Objects:—To carry on the business of electrical, wireless, mechanical, automobile and general engineers, &c. The permanent directors are:—S. T. Cooper, 24, Porter Street, Hull; and J. W. Rattle, 17, Park Lane West, Anlaby Park, Hull, electrical engineers.

A. T. M. Pension Trust, Ltd.—Registered as a private company December 31st. Nominal capital, £100 in £1 shares. Objects: To undertake and discharge the office and duties of the trustees of the existing pension fund for the benefit of the staff employés of the Automatic Telephone Manufacturing Co., Ltd., and the International Automatic Telephone Co., Ltd. The number of directors is to be five, two of whom shall be directors and nominees of the Automatic Telephone Manufacturing Co., Ltd., and three staff employés. The first directors are:—D. Sinclair, "Oakwood," Weybridge, Surrey; Sir Alexander F. P. Roger, Yockley House, Camberley, Surrey (nominees of the Automatic Telephone Mfg. Co., Ltd.); G. W. Moore, "Lynwood," Raleigh Close, Hendon, N.W.; A. R. Dodd, "Undercliffe," Cholmondeley Road, West Kirby, Ches.; H. H. Harrison, 51, Mayville Road, Mossley Hill, Liverpool (staff directors).

Tre-Coil Works, Ltd.—Private company. Registered January 1st. Capital, £300 in £1 shares. Objects: To acquire the goodwill of the business of electrical engineers now carried on at 5, Archer Street Works, Shaftesbury Avenue, W., by J. Dorn and R. Lurion, and the right to use the name of "Tre-Coil"; also to acquire all interest in certain inventions of J. Dorn relating to the manufacture and design of a three-coil cone speaker movement, &c. The directors are:—S. Freudenberger, 2, Aldermanbury Buildings, E.C.; J. Dorn, 91, Charlotte Street, Westminster, S.W.; R. Lurion, 40, Dean Street, W.1. Solicitors: Rowe & Wilkie, Stevenage House, Holborn Viaduct, E.C.1.

T.B. Drum & Manufacturing Co., Ltd.—Private company. Registered January 3rd. Capital, £3,000 in £1 shares. Objects: To carry on the business of manufacturers of or dealers in gramophones, amplifiers, loud speakers, and all accessories; manufacturers of and dealers in dynamos, generators, accumulators, batteries, motors and all mechanical appliances used in connection with gramophones, automatic and electrical machines, &c. The directors are:—T. A. Thompson, 59, Gloucester Road, Finsbury Park, N.; W. J. Argent, 93, The Drive, Cranbrook Park, Ilford, Essex; F. E. Darrington, 169, High Road, Salway Hill, Woodford Green, Essex. Registered office: 6, Seaford Street, Gray's Inn Road, W.C.1.

Junction Engineering Co., Ltd.—Private company. Registered January 4th. Capital, £1,500 in £1 shares. Objects:—To acquire the business of a mechanical and electrical engineer now carried on by A. T. Smee, A.M.I.E.E., as "The Junction Engineering Co.," at 149a, Junction Road, N.19. The subscribers (each with one share) are:—A. T. Smee, 146, Duke's Avenue, Muswell Hill, E.10, electrical engineer; S. Thurlow, 42, Olinda Road, Stamford Hill, N.16, solicitor's clerk. A. T. Smee is permanent governing director. Registered office: 149a, Junction Road, Highgate, N.19.

Allands, Ltd.—Private company. Registered January 4th. Capital, £2,100 in 2,000 ordinary shares of £1 each and 1,000 founders' shares of 2s. each. Objects:—To carry on the business of designers and manufacturers of, and dealers in all kinds of electrical fittings and lighting and radio apparatus, &c. The directors are:—E. Parkinson, "Hurstbourne," Marlborough, Bournemouth; F. Alland, 21, Lewes Road, North Finchley, Middlesex; E. G. V. Alland, 9, Queen's Road, Muswell Hill, N. Secretary: F. Alland. Registered office: 7, Duke Street, Manchester Square, W.1.

Zendix Electric Co., Ltd.—Private company. Registered January 2nd. Capital, £100 in £1 shares. Objects:—To carry on business as manufacturers and merchants of the "Zendix" electric brush, and manufacturers of, and dealers in all kinds of electrical appliances and to acquire the trade mark "Zendix." The first directors are:—J. Corfield, "Woodstock," Sutton, Surrey, company director; L. W. C. Edwards, Belmont Avenue, New Malden, manager. Secretary: F. W. Pidduck, 25, Albert Road, Mitcham. Registered office: 93, Mortimer Street, W.1.

Official Returns of Electrical Companies.

Nantwich Electric, Ltd.—Mortgage on 5, Hospital Street, Nantwich, Cheshire, dated December 15th, 1928, to secure £66. Holder: G. A. Racklyeft, Pillory Street, Nantwich, Cheshire.

Epoch Electrical Society, Ltd.—Debenture dated December 14th, 1928, to secure £350, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: A. H. Hurst, Holland House, Bury Street, E.C.

Samdon Wireless Co., Ltd.—Debenture dated December 14th, to secure £150, charged on the company's property, present and future, including uncalled capital (subject to prior debenture dated July 24th, 1928). Holder: M. Morris, "Woodcroft," Broom Lane, Higher Broughton, Lancs.

"K.N." Electrical Products, Ltd.—Debenture dated December 7th, 1928, to secure £1,000, charged on the company's property, present and future, including uncalled capital. Holder: P. Ferguson, "The Garth," Grange Road, Highgate, N.

Metropolitan Electric Supply Co., Ltd.—Satisfaction in full on July 9th, 1928, of trust deed dated May 15th, 1917, securing £250,000 debentures. (Notice filed December 20th.)

Hendon Electric Lamp Co., Ltd.—Debenture dated December 21st, 1928, to secure £750, charged on the company's property, present and future, including uncalled capital. Holder: J. W. Kilby, 7, Newlands Avenue, Thames Ditton.

City Notes.

Reduction of Capital.

BRITISH ARCA REGULATORS, LTD., & REDUCED.—An order confirming the reduction of the company's capital from £60,000 to £30,000 was made by Mr. Justice Eve in the Chancery Division on December 17th.

Official Notice re Companies.

The names of the following companies are to be struck off the register unless cause to the contrary is shown within three months:—

Anode Wireless and Scientific Instruments, Ltd.
Associated Electric Traders, Ltd.
British Radio Sales Co., Ltd.
Coventry Wireless Supplies, Ltd.
Diamond Wireless, Ltd.
Electrolite, Ltd.
Electric Lamp Regenerators, Ltd.
Holborn Electric Fires, Ltd.
Holborn Radio Co., Ltd.
Humavox, Ltd.
Jenner Light and Power Co., Ltd.
Maywood Engineering and Electrical Manufacturing Co., Ltd.
Mitchell's Electrical & Wireless, Ltd.
Modern Electrical Supply Co., Ltd.
National Wire Manufacturing Co., Ltd.
New Vacuum Cleaner Co., Ltd.
Park Royal Engineering Works, Ltd.
Re-Echo Electrical Mfg. Co., Ltd.
Solray Co., Ltd.
Sunbeam Light Co., Ltd.
Swift Electrical, Ltd.
Tele-Dis (Founders Co.), Ltd.
Wireless Installations, Ltd.

Shawinigan Water and Power Co.

At a special general meeting of the shareholders of the Laurentide Power Company held in Montreal on December 18th, the offer of the Shawinigan Water and Power Co. to purchase the entire assets of the company was formally accepted. The deal gives the Shawinigan Company power control of the St. Maurice River, below the Laurentide development, and virtual power control of the entire river, owing to the rights recently secured on the upper part of the river.

United River Plate Telephone Co., Ltd.

It was announced last week that the holders of over 90 per cent. of the company's ordinary shares had signified their acceptance of the offer to purchase their holdings recently made on behalf of the International Telephone & Telegraph Corporation. The transaction will accordingly be carried through.

Metropolitan Railway Co.

The directors report that the total traffic receipts for 1928 amounted to £1,854,000, an increase of £59,000 as compared with 1927. This increase was due entirely to an advance in passenger traffic revenue, the goods receipts having shown a decline.

Sir W. G. Armstrong, Whitworth & Co., Ltd.

It is announced that the scheme for the final reconstruction of the company will shortly be completed and presented to the holders of the company's debentures, notes and shares.

Allen-Liversidge, Ltd.

An interim dividend of 5 per cent. has been declared on the ordinary shares.

Anglo-American Telegraph Co., Ltd.

The following final dividends have been declared: Ordinary consolidated stock £1 10s. per cent. (making £3 15s. per cent.); and preferred stock £1 10s. per cent., making £6 per cent. The deferred stock is to receive a dividend of £1 10s. per cent. for the year. These rates are similar to those paid for the preceding year.

North Metropolitan Electric Power Supply Co.

An extraordinary meeting was to be held yesterday (Thursday) for the purpose of considering a resolution providing for the raising of the company's capital by £250,000 by the immediate issue of £1 ordinary shares.

Italian Company.

The *Società Italiana Radio Maritima* is making an issue of debentures amounting to 12,061,500 lire, chiefly for the purpose of completing the payment for equipment for Italian merchant vessels purchased from the Marconi International Marine Communication Co., Ltd., and the Cie. Générale de Télégraphie sans Fil.

Stocks and Shares.

MONDAY EVENING.

THE first week of Stock Exchange business in the New Year witnessed a good deal of activity, and brought about price improvements in most of the markets connected with investment and speculative investment interests. There is still no stringency in the money market, and it seems tolerably evident that, unless something very unforeseen occurs, the 4½ per cent. Bank Rate instituted in April, 1927, will serve its purpose for at least a couple of years. Various large loans are appearing, and others are on the point of making their appeal to the public So long as national trade continues quiet, capital will be compelled to seek Stock Exchange sources for its employment, and, considering the remarkable successes which a good many speculative investors enjoyed in their last year's engagements, it is not very surprising that Stock Exchange brokers should be bombarded with inquiries for stocks and shares that can be relied upon to advance in price during 1929.

The Pressure of Purchasers.

The difficulty is to find the stock which will satisfy the demands of the inquirers. So far as these particular columns are concerned, efforts are made to confine suggestions to stocks and shares of the investment order. This may be regarded as a somewhat humdrum ambition, but we deal with an industry and its branches in which there is more scope for useful work than for gambling opportunities. At the same time, the public are wide-awake to the chances which offer, even in connection with good-class investments. British Insulated, Callenders, Henley's, are moving up, under the constant pressure of buying orders. These, coming into a market in which a meagre supply exists to meet them, are not to be gainsaid by the scarcity of stock, but insist upon being satisfied, and prices are consequently forced up to what, judged by current dividend payments, appear to be very high levels. At the same time, it is impossible to advise sales of shares in such companies as these, for unless the whole of the financial position is going to alter very considerably indeed during the present year, it is a valid supposition that investment will exert cumulative force, and that prices may go still higher than they stand to-day.

General Electrics Boom.

General Electrics have come in for a striking jump in the price, on New York purchases. Last Friday morning the shares were standing about 45s., when orders arrived from the United States to buy the shares at the best prices at which they could be obtained. Within less than an hour, General Electrics had gone up nearly £1 a share to 65s., and, so far as people on this side were concerned no particular reason appeared for such a spectacular jump. So far as American control of the company on this side is concerned, it will be remembered that steps have been taken to ensure the control of the G.E.C. being retained in British hands. Some Stock Exchange people declared that Americans had gone mad in buying General Electrics at such a price, and pointed to the dividend of 10 per cent. as showing the rise to be unjustifiable. Such a quotation has had the effect, no doubt, of bringing in shares to market, though it is well known that few people care to sell on a rise, preferring to wait until the market has turned, when they start to think about realising.

The Shareholder's Dilemma.

What the holders of General Electric shares ought to do at the present time it is extremely difficult to say. The majority of British shareholders in the company will have paid considerably less than £3 for their shares, but the holders wish to make the best, naturally, of their investment, and the mere fact of the mystery which surrounds the rise is in itself sufficient to give a man pause before he determines to let his shares go. On the face of it, General Electrics, which paid a dividend of 10 per cent. last year and 7½ per cent. in

the preceding twelve months, are not worth anything like £3 a share. On the other hand, there may be developments afoot of which the British investor is at present ignorant. The man who wishes to put himself on velvet in regard to his holding, and at the same time to make the best of both possible worlds, will probably elect to sell half the shares and to keep the remainder.

Strength in Equipment Shares.

The dramatic jump in the price of General Electrics has served to draw attention to other members of the manufacturing group, although these latter are without trans-Atlantic support up to the present. There are rises in British Insulated, Callenders, Henleys, Enfields, Telegraph Constructions, &c. Ever-Ready shares have gone up to 32s. 3d. The rise in Enfields has now lifted the shares to nearly £1 above the price at which they stood shortly before Christmas. There are, however, few shares on offer of any of these companies, and, with investment in its present almost truculent mood, holders of existing securities are in no hurry to part from them. British Aluminiums are again harder, but no recovery has yet occurred in British Electric Transformer preference. New issues are contemplated by the Newcastle and District Company, and by the North Metropolitan. Details are not yet available, but the knowledge of the newcomers helped to stiffen the quotations for the existing shares.

"Tube" Developments.

Underground Electric incomes have gained 3 points, at 129, and the railway market as a whole is very firm. Metropolitans rose 2; Metropolitan District 4½ per cent. first preference advanced to 82¼. The dividend announcements in respect of this group are expected to be made public in the second week of February, and, as already mentioned here, the estimates of what the Underground Company will pay on its £1 shares vary from 7½ to 10 per cent. The Underground Electric Railways Company of London is constantly extending its sphere of operations. Now that the enormous new work at Piccadilly Circus station is finished, the directors will have more time and attention for considering the scheme that will carry on the Piccadilly line from Hammersmith, its present western terminus, to Richmond. So far as we are aware, this idea has been discussed only amongst the board, but the increasing pressure of traffic renders it a matter that will have to be dealt with, and boldly, in the fairly near future. The tube line, which at present runs parallel with the District between South Kensington and Hammersmith, can be linked to a part of the District which now goes to Richmond, over which the traffic is becoming continually denser.

Cable Stocks.

Great Northern Telegraphs have been moving in a manner very different from their ordinarily staid behaviour. Last week's price showed a gain of 4½ points, this taking the price to 34½. Later, it rose to 35, and then came back to 32. The reason for the violence of the fluctuation seems to be no more than a little dealing in a very restricted market. The Eastern group is better, Eastern ordinary being up to 270½, which makes a gain of 8½ points within a fortnight. Anglo-American deferred rose to 25½. On the other hand, Automatic Telephones gave way to £2, on the disappointment felt by proprietors with the extremely conservative dividend policy pursued by the Board. Oriental Telephones are ex rights; after being 2⅜, the price spurted to 2⅞. Marconis are unusually quiet: there is no change on the week in the ordinary shares at 78s. 9d. Canadian Marconis stand at £2. To match this against General Electrics would be, of course, to draw a very unfair analogy, but it is impossible to forget that Canadian Marconis were run up one night, on American buying, to £6 a share, a price from which they reacted to the present level within a very short space of time. No comparison, we repeat, can be drawn between the two undertakings, but the violence of the movement in the prices may not be without significance, seeing that American dealing lay at the back of the fluctuations.

Electric Light and Traction.

Electricity supply shares are better for choice. The feature is a jump in County of London ordinary to 48s., being 3s. 6d. up on the week, a rise due to a spurt in Bournemouth and Poole ordinary to 3½, showing a gain of half-a-crown. Metropolitans are also a good market at 46s. 3d. North Metropolitan ordinary advanced to 50s. 6d., and the list, as a whole, although being without many quotable changes, is distinctly firm.

British Electric Traction deferred ordinary at 650 records a nominal rise of 35 points. Other movements in traction and tramway share issues are less sensational; Brazilian Tractions put on a point, Calcutta Tramways ordinary rose to £1, Anglo-Argentine Tramways debenture is a little better, and the Mexican group is practically unchanged, the only alteration being a small gain in Mexican Light and Power first mortgage bonds. Para Electric Railway and Light shares rose to 4s. Amongst dollar stocks, Shawinigan Water at 90½ is better on the week, Canadian and American utilities being in quiet demand.

The rubber share market shows a tendency to improve, but there is no business doing. The iron and steel group holds its own, the North contributing a certain amount of support to shares which are locally popular.

Share List of Electrical Companies.

	Nom.	Dividend. 1926.	Dividend. 1927.	Price Jan. 7, 1929.	Rise or fall.	Yield, p.c.
HOME ELECTRICITY COMPANIES.	£					
Bournemouth and Poole	1	14†	15	3½	+⅛	... ...
Brompton Ordinary	1	8¾	8½	27/-	—	5 8 8
Charing Cross Ordinary	1	8½	8½	26/6	—	5 8
do. do. 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8⅝	8⅝	27/-	—	5 8 8
City of London	1	10	10	30/9	—	4 16 0
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	38/6	—	4 3 0
County of London	1	7½	7½	48/-	+3/6	3 2 6
do. do. 6% Pref.	1	6	6	23/6	—	5 4 4
Edmundsons' 7% Pref.	1	7	7	25/6	—	5 9 10
Elec. Supply Corporation	1	11	11	50/9	—	4 6 8
Kensington Ordinary	1	8	8	26/6	—	5 5 8
Lancs. Light and Power	1	7½	7½	30/-	—	5 0 0
London Electric	1	8½	8½	26/-	—	5 7 8
Metropolitan	1	8	9	46/3	—	3 18 0
do 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6	6½	30/-	—	4 6 8
Mid. Elec. Power	1	—	15	2	—	... ...
Newcastle-on-Tyne Ordinary ...	1	5	6	26/3	—	4 11 5
do. 7% Pref. ...	1	7	7	26/-	—	5 7 8
Notting Hill 6% Pref.	10	6	6	10⅝	—	5 11 7
North Met. Elec. 6% Pref.	1	6	6	23/-	—	5 4 4
St. James' and Pall Mall	5	8	8	27/6	—	5 1 10
Scottish Power	1	8	8	31/6	—	5 1
South London	1	8½	8½	27/6	—	5 2 8
Urban Ordinary	1	7	7	26/9	—	... ...
Westminster Ordinary	1	8½	8½	27/-	—	5 8 8
Whitehall Elec. Invst. 7½% Pref....	1	7½	7½	24/-	—	6 5 0
Yorkshire Elec.	1	8	8	35/-	—	4 11 5
HOME RAILS.						
Central London Ord. Assented ...	Stock	4	4	78	—	5 9 7
Metropolitan	,,	8	8	67½	+2½	4 9 0
do. District	,,	3½	4	80½	—	4 19 5
Underground Electric	£1	1½	5	27/-	+6d.	3 14 1
do. do. Income ...	Bonds	6	6	129	+3	4 13 0
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	Stock	6	6	103½	—	5 16 0
do. Def.	,,	1½	1½	25½	+½	5 17 8
Automatic Telephone	1	10	10	2	—1/16	5 0 0
Eastern Extension	10	10	10	26⅞	+⅛	*3 14 3
Eastern Tel. Ord.	Stock	10	10	270½	+3	*3 14 0
Globe Tel. and T. Ord.	10	10	10	25½	+½	*3 18 6
do. do. Pref.	10	6	6	11xd.	—	5 9 1
Great Northern Tel.	10	20	20	32	—2½	... ...
Indo-European	25	10	10	47½	—	*5 5 9
Marconi	10/-	5	*10	8⅛	—	... ...
Marconi-Marine	1	8⅝	12½	8⅝	+	3 9 1
Oriental Telephone Ord.	1	12	12	2⅞xr	—	... ...
United R. Plate Tel.	5	8	8	12	+½	*3 6 8
Western Telegraph	10	10	10	26½	—	3 15 0
HOME AND FOREIGN TRAMS, &c.						
Anglo-Arg. Trams First Pref. ...	5	5½	5½	8⅝	—	7 11 9
do. do. 2nd. Pref. ...	5	6	6	3/16	—	3 14 6
do. do. 5% Deb. ...	Stock	5	5	77½	+½	6 9 0
British Electric Traction Def. Ord.	,,	—	—	650	+35	... ...
do. do. Pref. Ord.	,,	8	8	124	—	6 9 1
Brazil Traction	100	6	7	73½	+1	3 4 6
Brit. Colombia Elec. Rly. Pcs. ...	Stock	5	5	90½	—	5 2 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	13/-	—	... ...
London United Tram Deb. ...	Stock	4	4	61	—	6 11 4
Mexico Trams, 5% Bonds	—	5	5	79	—	6 6 7
Mexican Light Common	100	Nil	Nil	7/8	—	... ...
do. 7% Pref.	100	Nil	7	78½	—	9 3 0
do. 1st Bonds	—	5	5	77½	+½	6 9 0
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... —
MANUFACTURING COMPANIES.						
Babcock & Wilcox	1	12	15	3⅛	—	*4 5 9
British Aluminium Ord.	1	10	10	2 1/16	+1/16	*4 6 7
British Elec. Transformer Pref....	1	7	7	15/-	—	9 6 8
British Insulated Ord.	1	15	15	4⅜	+½	3 8 6
Brush Ord.	1	10	10	28/9	—	6 19 3
Callenders	1	15	15	4 1/16	+½	3 9 0
do 6½% Pref.	1	6½	6½	1 1/16	—	5 9 5
Crompton Parkinson Ord.... ...	5/-	—	—	19/6	—	... ...
do. 6% Pref.	1	—	3	25/-	—	6 8 0
Edison-Swan	4/-	10	10	19/6	—	3 4 0
do. 5% Deb.	Stock	5	5	86½	—	5 15 7
Electric Construction	1	7½	7½	26/9	—	5 12 1
Enfield Cable Ord.	1	20	20	1⅝	+⅛	3 14 6
English Electric	1	Nil	Nil	7/6	—	... ...
do. do. Pref	1	8	Nil	10/-	—	... ...
Gen. Elec. Pref.	1	6½	6½	23/6xd.	—	5 10 8
do. Ord.	1	7½	10	3	+16/3	3 6 8
Henley	1	25	25	5 1/16	+1/16	4 6 2
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	Nil	Nil	11/8	—	... ...
Johnson & Phillips	1	12½	10	36/3	—	5 10 8
Met.-Vickers Ord.	1	8	6	30/-	—	... ...
do. Pref.	2	8	8	2⅜	—	5 16 5
Siemens Ord.	1	7½	7½	26/3	—	5 14 2
Telegraph Construction	12	10	10	23	+½	*4 14 6

†4% of which was tax free.

*Dividends paid free of Income Tax.

A Review of the Trade Situation in China.

Prospects for British Manufacturers and Merchants.

SOME light is thrown upon the complexities and difficulties of Chinese affairs in a report recently prepared for the Department of Overseas Trade by Mr. H. H. Fox, C.M.G., Commercial Counsellor at the Peking Legation. (Stationery Office, 2s. 6d. net.)

Mr. Fox commences his review of the commercial, industrial and economic situation in China with a number of hints to merchants and manufacturers. As an initial step towards trading with China, the author counsels communication with the Department of Overseas Trade, preferably by means of a personal call. It is essential that as full information as possible regarding prices, discounts, agency terms, &c., should be given. The Department is in a position to advise manufacturers on the subject of agencies and to hold the balance between manufacturers who expect agents to buy machines and sell quantities of them in a virgin field for the usual trade discount, and agents who consider that manufacturers should contribute generously to their office expenses, provide them with advertising matter, and stocks on consignment in return for a promise that they will do their best to sell the goods at some unspecified date. Happily there now appears to be growing co-operation between the two interests, and the trading risk is shared in fair proportions. No new business should be entered into with an unknown Chinese firm before careful inquiry as to its standing has been made. Here, again, the Department can be of assistance. It is agreed that the Chinese are eminently satisfactory people to deal with, but that conditions and customs are liable to engender misunderstandings. Adequate advertisement is now indispensable in China; there are a number of experienced firms known to the Department who specialise in this class of business. Passing mention is made of the unsettled state of the law covering trade marks, patents and copyright. In dealing with the question of tariffs, Mr. Fox expresses a hope of better conditions with the granting of tariff autonomy to China, coupled with the Nationalist Government's promise to abolish *likin*, *i.e.*, internal dues and taxes.

An Obscure Situation.

Proceeding with the survey proper, the author confesses that most of the information available is inadequate and unco-ordinated; consequently it is extremely difficult to generalise or express any unqualified opinion. In spite of the varied disabilities from which trade has suffered, the import and export trade has continued to grow during the past five years. This has led observers to conclude that conditions are not so bad as they have been painted, but the Customs returns are not an entirely accurate barometer of the state of trade. For instance, in 1927 there was an all round decrease in the trade of Shanghai and the Yangtze ports, but this was compensated for by the increased trade done at Tientsin and other northern ports. The inflation of the tael has increased the trade figures; again, there have been abnormal imports of rice and other cereals to make up for bad crops and famine relief. It is also emphasised that the figures only show goods upon which duty has been paid and not necessarily goods that have been paid for.

Mr. Fox says that there is undoubtedly a growing market for British goods, but, for the time being, the demand is restricted owing to the prevalence of civil war with interruption of communications with the interior, a general sense of insecurity among dealers, and a variety of minor causes. "No one can live the best part of a lifetime in a country of such vast and almost unlimited possibilities as China without being an incurable optimist as to the future of the country and its people, but it must be admitted that the events of the past two years have made heavy drains on one's fund of optimism." After detailing a few of the ills to which China is still subject, Mr. Fox says that, after all, there is a ray of hope in the sterling good sense of the Chinese people, their innate love of peace, their remarkable capacity for "carrying on" in the face of apparently insurmountable obstacles, and their ability to recover rapidly from any setback.

Transportation has been very severely affected by the internecine strife. The once-flourishing railway system of China has been reduced to a deplorable state of disorganisation and bankruptcy. With one or two exceptions, China's railways are crippled for the purpose of commercial transport, and are only able to maintain skeleton services. It is, however, a hopeful sign that this threat to the economic life of the nation seems to be fully realised by the new Nationalist Government, which is doing its best to bring order out of chaos. But the crying need is the restoration of the railways to civil control and the provision of funds for the purchase of new material, knotty problems which economic conferences and elaborate plans for rehabilitation have so far been unable to solve. Efforts to construct roads are being made in all parts of the country, but most of these roads are badly made, due to lack of experience and funds.

The Machinery Trade.

The report states that the machinery trade, in common with all others, received a serious set-back in the early part of 1927, but during the first half of 1928 considerable improvement was shown in spite of generally disturbed conditions; a number of orders for industrial plant were placed, and there were numerous inquiries. During the year ended June 30th last a certain number of orders were placed for electric power plants, but British manufacturers were not very successful on the whole. An order for two 10,000-kW sets for the Chapei Electric Light Works (Chinese) was placed in Austria. On the other hand, the machinery required for a considerable extension of the power station of the Shanghai Municipal Council was purchased in the United Kingdom. A complete electric power plant for the Harbin tramway system, with cars, &c., was ordered from Germany during the year, but the boilers, engine and pumps were ordered from England. A new generator and several electric motors, with Anglo-American presses, were ordered from Great Britain for a British-owned oil mill in Harbin. A 1,000 kW turbo-alternator, with American boilers, was ordered by a Chinese electric light company in Harbin. As regards Tientsin, the orders placed in Great Britain during the year included one for a 10,000 kW set for the Peking Electric Light Works and an electric locomotive and accessories. A Belgian concern received a contract for an electric power plant and a 1,500-kW Swiss generator was ordered for a Chinese cotton mill. An American firm secured a contract for the extension of the Tsinanfu Electric Light Works; the generating plant is American, but the boilers are British. The imports of machinery for electric power stations during 1927 were valued at 1,291,351 Haekwan taels, as compared with 831,606 taels in 1926. (£1 = 7 taels approx.)

The production of electrical materials and fittings in China is still of insignificant proportions, but the Chinese are showing what they can do once normal conditions are restored. During 1927 the imports of this class of goods were valued at 9,867,796 taels, against 8,941,185 taels.

Southern Manchuria.

Appended to the main report is a review of the trade of South Manchuria in 1927-28 by Mr. M. E. Dening, the acting British Consul at Dairen. In 1927 the bulk of the trade went to Japan; the British Empire and Germany were second and third, with nearly equal shares. From the four leading countries electric power station machinery valued at 213,677 taels was imported into Dairen. This total was made up as follows: Great Britain 122,468 taels, the United States 63,789 taels, Japan 13,914 taels, and Germany 13,506 taels. The power stations at Anshan, Fushun, Changchun and Dairen have recently been extended. The electrification of the railways from Fushun to Mukden, Dairen station to Dairen wharves, and Nankuanlung station to the new coaling pier at Kanchingtzu being under contemplation, the purchase of further plant may be anticipated in the future. While the policy of purchasing in Japan whenever possible is studiously followed by the South Manchuria Railway, there is always a prospect of a market for machinery of a special nature not manufactured in Japan. There is keen competition, not only from the United States and Germany, but also from Switzerland and Czecho-Slovakia.

A Chinese National Products Exhibition.

The *Chinese Economic Bulletin* reports that a National Products Exhibition was recently held in Shanghai. It was organised under the auspices of the Minister of Industry, Commerce and Labour with a view to encouraging the development of Chinese industries. While the bulk of the exhibits were purely Chinese in character, *e.g.*, porcelain, paper, textiles, &c., there were also on view electrical appliances, radio apparatus, and scientific instruments.

Foreign Electrical Trade of Denmark.

Imports and Exports during 1926 and 1927 Compared.

THE following table shows Denmark's imports and exports of electrical machinery and apparatus in 1926 and 1927, indicating the principal countries of origin and destination. Notes of increases and decreases are also given. In spite of a fairly well developed export trade in electrical goods Denmark is still a considerable importer; but it will be noticed that Danish exports of electrical goods are increasing substantially in virtually every important line, including cables, batteries and dynamos, although electrical machinery imports are still greater in value than exports. In cables and insulated wire, Denmark seems now to be definitely showing her independence of foreign supplies. Imports of radio apparatus are still very large as compared with exports.

Imports.

	1926. Kr. (thous.)	1927. Kr. (thous.)	Inc. or dec. Kr. (thous.)
Electric cables—			
Total	286	217	− 69
From Germany	101	181	+ 80
Insulated wire—			
Total	1,023	994	− 29
From Germany	562	549	− 13
,, Sweden	58	72	+ 14
,, Holland	132	73	− 59
,, Belgium	110	121	+ 11
,, United Kingdom	71	54	− 17
,, United States	73	97	+ 24
Accumulators and plates—			
Total	1,493	1,286	− 107
From United States	202	224	+ 22
,, Germany	1,069	870	− 199
,, United Kingdom	149	170	+ 21
Installation material (switches, lampholders, fuses, &c.)—			
Total	1,676	1,794	+ 118
From Germany	1,208	1,265	+ 57
,, United Kingdom	127	112	− 15
,, Sweden	80	39	− 41
,, United States	43	94	+ 51
Dynamo lighting sets, ignition magnetos, &c.—			
Total	752	861	+ 109
From Germany	364	404	+ 40
,, United States	331	415	+ 84
Batteries and cells—			
Total	868	962	+ 94
From Germany	518	662	+ 144
,, United States	285	259	− 26
,, United Kingdom	27	27	—
Radio apparatus—			
Total	6,439	5,959	− 480
From Germany	3,512	3,022	− 490
,, United Kingdom	711	437	− 274
,, Holland	883	1,495	+ 612
Electrical machinery and apparatus not elsewhere specified—			
Total	536	475	− 61
From Germany	378	337	− 41
,, United Kingdom	45	30	− 15
,, United States	50	65	+ 15
Dynamos, generators, motors, transformers, stators, armatures, rotors, &c.—			
Total	2,614	2,886	+ 272
From Germany	1,030	970	− 60
,, United Kingdom	581	632	+ 51
,, Sweden	359	436	+ 77
,, United States	297	262	− 35
Telephone apparatus—			
Total	73	113	+ 40
From Sweden	26	14	− 12
,, Germany	24	29	+ 5
,, United Kingdom	10	58	+ 48
Electrical measuring instruments—			
Total	399	327	− 72
From Germany	319	243	− 76
Other electrical instruments—			
Total (mainly from Germany)	60	33	− 27
Vacuum cleaners—			
Total	1,673	2,254	+ 581
From Sweden	1,365	1,678	+ 313

Exports.

	1926. Kr. (thous.)	1927. Kr. (thous.)	Inc. or dec. Kr. (thous.)
Electric cables—			
Total	512	1,194	+ 682
To United Kingdom	38	420	+ 382
,, Poland	46	118	+ 72
,, Norway	34	232	+ 198
,, Sweden	165	251	+ 86
Motors and dynamos—			
Total	1,858	2,062	+ 204
To Sweden	423	254	− 169
,, Great Britain	227	404	+ 177
,, Norway	80	69	− 11
,, Argentina	165	248	+ 83
,, China	186	94	− 92
,, Spain	48	31	− 17
Insulated wire—			
Total	88	100	+ 12
Telephone apparatus—			
Total	30	10	− 20
Electrical measuring instruments—			
Total	36	25	− 11
To China	—	3	+ 3
,, Great Britain	6	12	+ 6
Installation material (switches, lampholders, &c.)—			
Total	658	719	+ 61
To Sweden	272	297	+ 25
,, Belgium	67	12	− 55
,, Great Britain	52	32	− 20
,, China	21	44	+ 23
,, Norway	57	67	+ 10
Batteries and cells (including flash-lamps)			
Total	5,954	7,268	+1,314
To Great Britain	1,681	1,665	− 16
,, Norway	456	630	+ 174
,, Sweden	1,375	2,046	+ 671
,, Finland	509	855	+ 346
,, Holland	192	145	− 47
,, Belgium	159	203	+ 44
,, Spain	381	298	− 83
,, Argentina	112	272	+ 160
,, British South Africa	215	665	+ 450
,, Australia	402	451	+ 49
Electrical machinery and apparatus, not elsewhere specified—			
Total	340	375	+ 35
To Great Britain	41	25	− 16
,, Sweden	43	46	+ 3
,, Holland	65	77	+ 12
,, China	13	40	+ 27
,, Japan	21	23	+ 2
,, Finland	40	57	+ 17
Wireless apparatus—			
Total	122	134	+ 12
To Sweden	30	36	+ 6
,, Iceland	26	53	+ 27
Electrical porcelain goods—			
Total	491	464	− 27
To Spain	84	58	− 26
,, Russia	120	127	+ 7
,, Great Britain	34	43	+ 9
,, Switzerland	136	203	+ 67

18 Kr. = £1 (approx.).

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

The " Teletypesetter."

A machine which, it is claimed, will be of considerable utility in newspaper and printing establishments employing plain type faces was recently demonstrated in America. As its name implies, it enables one typist to operate automatically and simultaneously any number of linotype machines. The basic feature of the new device is an electric typewriter which perforates ticker tape, each group of perforations corresponding to a letter or numeral. The code on the tape is then telegraphed electrically to a newspaper office, perhaps hundreds of miles away, and a tape in the latter office is similarly perforated and fed through a device attached to the linotype machine, electrical impulses translating the code into depressions of the keys which control the typesetting. It is estimated that linotype machines can be speeded up by means of the new device to do at least three times the amount of work done by human operators. The machines shown at the official demonstration produced eight lines a minute without a single stop; they can produce 90,000 ems a day. The Mergenthaler Linotype Company is at work on a machine that will conform to the highest production possibilities opened up by the new device. One of the possibilities is an enormous saving of time and labour in handling syndicated matter mailed by Press associations. At each end of the line a machine decodes and typewrites the perforations so that the operator may see a copy of the message he is sending and the person in charge at the receiving end may read it. An operator may control simultaneously typesetting machines in any number of cities by telegraphic connections. All the experimental work was done in the Morkrum-Kleinschmidt Corporation's factory in Chicago, Ill. The rolls of perforated tape will be a permanent record: book publishers will not be compelled to keep tons of metal plates in their files for the printing of new editions.

A Washing and Drying Machine.

The " Universal " electric washer and centrifugal dryer, fig. 1, recently introduced by Messrs. L. G. HAWKINS & CO., LTD., 30-35, Drury Lane, Kingsway, W.C.2, is specially recommended for use in hotels, clubs, hospitals, and large residences. It will, it is claimed, wash eight sheets, or the equivalent, in 15 min. In a separate compartment in which the clothes are placed after washing, the operations of rinsing, blueing, and damp-drying are carried out without further handling. By merely touching a safety lever (which cannot be operated until the lid is fastened down) this drying compartment revolves at a very

Fig. 1.—The " Universal " Washer and Dryer.

rapid rate, and by centrifugal force the water is extracted without fear of damage to the most delicate fabrics. The soap-suds extracted can be directed back into the washing compartment, the blueing water into a pail for use over again, and the rinse water directly into the sink. By means of a neat electrically-driven pump, forming part of the equipment, the water from the washing compartment is automatically emptied directly into the sink without having to make any hose or other attachments. The tubs are constructed of heavy-gauge copper throughout—nickel-plated inside and blue cellulose painted outside—all suitably mounted on a solid-steel structure specially treated against rust and finished in blue cellulose. Special castors enable the equipment to be readily moved without effort. The apparatus is fitted with a draining board and dryer container constructed of aluminium. The equipment is suitable for both a.c. and d.c. supplies, and the total loading is 200 W.

The " Super-Smoothwell " Automatic Iron.

There are several patterns of electric irons in which thermal cut-out devices are embodied, but the " Super-Smoothwell," to which our attention has been drawn by the makers, PREMIER ELECTRIC HEATERS, LTD., Keeley Street, Birmingham, can be

Fig. 2.—The " Super-Smoothwell " Iron.

Fig. 3.—The " Birka " Regulator.

allowed to remain in circuit without danger. This is accomplished by means of the " Birka " regulator. This device is placed in the element circuit, and consists of bi-metal strips and contacts in a vacuum tube. This is adjusted so that it

Fig. 4.—Sectional View of the Iron.

maintains the iron at the correct temperature, cutting off the current when the temperature rises above this level, and switching on again when it becomes necessary. Thus if the iron is left " on " no damage will result, and if it is left for a period during ironing operations it is always immediately ready for use. It is seen, therefore, that a great deal of trouble and waiting is obviated. In appearance the iron is very handsome, and the sole-plate is of improved design, having a curved " heel " instead of a square one, as is usual. The connector is substantial, the contacts are well shrouded, and a convenient thumb-rest is fitted. The appliance has a highly polished nickel-plate finish, and it is suitable for either d.c. or a.c. It will be seen that the iron should prove of considerable value in garment factories and similar places where it is essential that the working temperature should be maintained, and not exceeded, in spite of long intervals between operations. The loading is 500 watts; normally the hourly consumption, when idle, with the regulator working to keep the iron at the proper temperature, is 110 watt-hours. Fig. 2 illustrates the iron, fig. 4 is a sectional view showing the regulator in position, and fig. 3 depicts the regulator.

A Transformer Protecting Device.

The ALLGEMEINE ELECTRICITATS GESELLSCHAFT, Berlin, has lately brought out a thermo alarm for protecting oil-cooled transformers. The device is arranged to function when a definite oil temperature, which can be adjusted in steps of 5 deg. C. between 50 and 120 deg. C., is exceeded. It can be set to actuate either signalling devices or the trip coils of oil circuit-breakers, and is fitted with a small oil-immersed quick-acting switch, which opens or closes when a bi-metal strip deflects. The alarm is adaptable for pressures up to 400 volts, and requires no auxiliary relay.

Selected Radio-Telephone Apparatus.

Some Recent Developments and Improvements.

An " Elastic " Aerial Unit.

Methods of selective reception, some depending upon loose aerial coupling, others on the introduction of fixed series condensers, and still others on loose intervalve coupling, all have the equivalent effect of reducing the aerial pick up of anything but a narrow band to which the receiver is tuned. The regional broadcasting scheme may necessitate the operation of two powerful stations in one district with only a comparatively small difference of wavelength, with the result that with an average aerial and normal reacted detector circuit considerable overlapping interference may be experienced. If the receiver were made more selective by means of reaction, strong incoming signals from both stations would tend to swamp the detector and prevent closer reaction. Mechanical reduction of the aerial size would preclude reception from distant stations, while under some conditions the total removal of the aerial might not be sufficient to reduce the strength of the signals picked up on the coils or earth wire itself to the degree required. Therefore, an " elastic " aerial unit has been designed on the neutrodyne balancing principle: it inserts in the aerial circuit an auto-transformer coil (earthed in the centre) from the extreme ends of which reception signal voltages 180 deg. out of phase will be developed. To these two extremes are connected two fixed plates of a condenser and to a moving plate between them is connected the aerial terminal of the receiving set. If the movable plate is close to either fixed plate, the signal strength will be equal to that normally obtained with the aerial connected to the set itself, as the capacity is about 0.00025 mF. but as the movable plate approaches the centre position between the two fixed plates, not only will the series capacity be reduced to a very small value, but a reverse impulse will also be obtained from the other end of the coil. If the coils of the set, or the earth wire, pick up signals, then the balance will be slightly displaced towards that end of the coil which will give a reverse impulse to compensate for the signals obtained on the coils of the set, or the earth wire. Thus an aerial can be varied from its maximum down to absolutely nothing, and by perfecting the balance the local station fully tuned in with two h.f. valves in a 5-valve set can be cut out to zero by a fraction of a turn of the knob. The use of this unit, which is marketed by Metro-Vick Supplies, Ltd., with a small aerial for portable sets, in conjunction with a frame aerial, will allow extra signal strength without destroying selectivity; moreover, it forms an ideal volume control device, and is applicable to simple 2- and 3-valve reacted detector circuits, as well as to multi-valve sensitive receivers, which are often swamped by being used on too large aerials.

Measuring Instruments.

Messrs. Ferranti, Ltd., have added to their standard line of moving-coil instruments a thermo-couple pattern, fig. 1, for use primarily at radio frequencies. A long scale (2½ in. on a 2½-in. diameter instrument), good damping, and accurate workmanship are features; the thermo-couples are in vacuo

Fig. 1.—Thermal Milliammeter.

for the lower ranges and in air for the higher. The lowest range is 25 milliamperes, which is also used for voltmeters, and the upper 5 amperes, all in the 2½-in. size. The couples are insulated from the heater, thus avoiding capacitance effect of the movement to earth and reversal error on d.c. The instruments are equally accurate at high frequencies, electricity supply frequencies, or direct current, and one of them has been in satisfactory operation for some time on a three-metre wavelength. Temperature compensation is good, less than 0.1 per cent. per deg. C., and the overload capacity is about 50 per cent. momentarily. The moulded insulating cases are particularly suitable for high frequencies. Unlike the old thermo-expansion type, the consumption is very small, in the case of the 25-mA size being about 20 milliwatts. A complete d.c. testing set of first-grade accuracy in a small case (fig. 2) comprises a separate voltmeter and ammeter, the ranges obtainable with each instrument being nine: sixteen are marked on the switch knobs, whilst the other two are obtainable from the movements alone. The voltmeter ranges are 100 and 500 mV, 1, 5, 10, 50, 100 and 250 V, and those of the ammeter 10, 50, 100 and 500 mA, 1, 5, 10 and 25 A. In addition, as the voltmeter has a 1-mA movement, it may be used on the 100-mV range as a milliammeter to 1 mA, and the ammeter is similarly standardised for 75 mV to enable external shunts to be used, an additional terminal being provided for that purpose. The voltmeter is of such a high

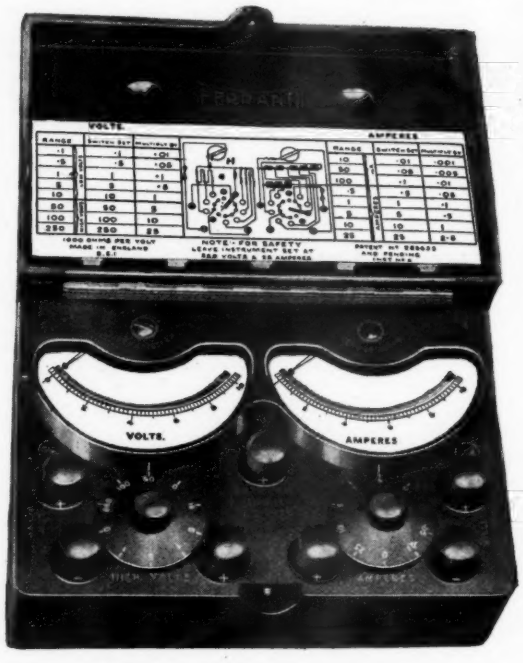


Fig. 2.—Multi-range Testing Set.

resistance (1,000 ohms per volt) that the consumption is negligible, the total resistance on the 250-volt range being a quarter of a megohm. Mirror scales and knife-edged pointers are provided, and the overload capacity of each instrument is very high, so that little chance of damage arises should a high-voltage accidentally be connected to a lower range. The instrument is a complete d.c. testing set of wide range; to enable valve tests to be made, in addition, a set of leads and plugs may be obtained for the direct indication of the quantities required for valves actually in use in a radio set.

A Glass Accumulator.

The " Monolt " 6-volt accumulator made by the Tudor Accumulator Co., Ltd., consists of three cells in a moulded monobloc English-glass box, which eliminates the usual wooden crate necessary to hold individual cells together. The seven-plate sections, having a capacity of 30 ampere-hours at the 10-hour rate, or 34 ampere-hours at the 20-hour rate of discharge, are firmly positioned in the compartments, which have moulded internal ribs to support the plates from underneath. The plates are over 3/16 in. thick, and are separated by treated wood boards. The moulded ebonite lids are sealed with compound which can easily be removed, and special screw-in vent plugs prevent any spraying during charging, an important point when the battery is used in conjunction with a charger at home. The terminals are non-corrosive and provided with vaseline chambers.

The glass box is provided with four small moulded feet and lugs on the ends of the box support a metal handle which can be readily detached. The centre cell is provided with specific gravity indicator floats, the positions of the balls being an indication of the specific gravity of the acid and the state of charge. The " Monolt " can be discharged at rates up to three amperes, and will therefore supply ample current for exciting the field of a moving-coil loud-speaker in addition to heating the valve filaments, the total weight with electrolyte being 18 lb., and the overall dimensions 8 by 5 by 8 in. high.

Pulverised Fuel Operation in the United States.

A Summarised Report on Recent Progress.

THE "Serial Report of the Prime Movers Committee" on Pulverised Fuel is issued by the National Electric Light Association of New York, and the following notes which have been made on the report for the period 1927-1928, it is hoped, will be of interest.

The report indicates that the use of pulverised fuel has increased appreciably in the United States and Canada during the past year, both in large public utility plants and in industrial works. The boiler h.p. served by pulverised fuel has increased by some 170,000 h.p. over the preceding year, and an addition of 169,000 h.p. has been contracted for. Below is given the total boiler h.p. served by the central and unit systems, respectively, in public utility plants and industrial works for the years ending 1926-27-28; the outstanding feature of these figures is the extended use of the unit-fired systems, especially in industrial plant.

Public Utility Plants.

Year ending.	Total H.P. of Boilers.		Average H.P. of Boilers.	
	Central sy tem.	Unit system.	Central system.	Unit system.
1926 ...	260,000	45.000	1,900	500
1927 ...	290,000	90,000	1,700	1,000
1928 ...	315,000	130,000	2,500	1,300

Industrial Plants.

Year ending.	Total H.P. of Boilers.		Average H.P. of boilers.	
	Central system.	Unit system.	Central system.	Unit system.
1926 ...	108,000	80.000	1,100	650
1927 ...	118,000	160,000	1,000	700
1928 ...	140,000	240,000	1,300	900

It is also to be noted that the unit system is now being applied to much larger boilers than formerly; until 1926, this system was considered only for comparatively small plants. It must be remembered, when referring to this table, that an American "boiler h.p." is equal to 10 sq. ft. of heating surface, or to an evaporation of 34.5 lb. from and at 212 deg. F. Preheated air is being more generally used in the mills for drying the coal, which has in its favour lower first cost and smaller building requirements, also simpler operation. Preheated air is also being used for external dryers, though in some cases steam dryers have been more successful, especially when using lignite. In connection with the dust and ash problem, the location of the exhauster fan on the return side of the cyclone which places the milling system, except for the short length between mill and exhauster, under vacuum, has proved to be a decided improvement; the maintenance of the exhauster blades has been reduced considerably, and the power consumption also somewhat lessened. In one case, the blades, after being in service for a considerable period, showed no signs of wear, the hammer marks being clearly visible on the projecting rivets. The coal in the return main is generally of a very fine nature and causes very little wear. The saving of energy in this particular case was equal to 1 kWh per ton milled.

Tests on the Cottrell electrical dust precipitators installed in one large station are of interest. These precipitators originally consisted of positive electrodes of corrugated steel sheets placed 4 in. apart, the negative electrodes being wire rods, suspended 6 in apart. Trouble was first experienced by arching between the sheets, and the electrodes were redesigned. The positive electrode is now a reinforced concrete slab 2 in. thick, containing ½-in. reinforced bars spaced vertically at 6-in. centres. The slabs are 18 ft. high and 6 ft. wide, and are placed 8 in. apart and parallel to the flow of gases. The negative rod is the same size as before. There are three passes in each precipitator. The voltage used varies from 35 000 to 50,0 0 volts according to the adjustment of an auto-transformer. A synchronous motor working from a low-pressure supply drives the rectifier, the commutators of which are fitted to arms on an extension of the motor shaft. Satisfactory operation was obtained with the gases flowing through the precipitators at 8 ft. per second, the time taken to pass through the machine being not less than 1.75 seconds. The results of tests indicate that for this particular plant the percentage of ash deposited in the furnace bottom increases as the boiler load is increased. Thus, with the furnace releasing heat at the rate of 12,000 B.th.u. per cubic foot, 20 per cent. of the ash is deposited in the furnace and 80 per cent. in the precipitator. If the furnace rating is 17 000 B.th.u. per cubic foot, 45 per cent. will be deposited in the furnace and 55 per cent. in the precipitator. At the 20,000-B.th.u. rate the precipitator only accounts for some 38 per cent. Tests were made with a scrubber-type gas washer with eliminator plates, located between the boiler outlet and the air heater; it was found that 6.9 per cent. of the original ash was discharged to atmosphere, and approximately 40 per cent. eliminated by way of the ash pit. The final flue-gas temperature was reduced by some 88 deg. by passing through the washer, enabling the induced-draught fan to deal with heavier loads. The draught loss across the washer varied from 0.10 to 0.35 in. of water. The sulphuric acid fumes do not appear to be greatly reduced by the use of the washer; this appears to be an important point. It is interesting to note that in one case in which complaints were received of ash being deposited on neighbouring premises, the matter was successfully settled by placing a sample of ash from the station and another found on the premises under a microscope; the peculiar characteristics of pulverised-fuel ash were then found to be strongly different from those of the ash usually found around the houses concerned. The colour of the ash also helps to distinguish pulverised-fuel ash from that discharged by mechanical stokers.

The use of the turbulent type of burner has increased, and the results indicate that this type of burner makes possible a much smaller furnace. This has brought about severe conditions in the combustion chamber, and with coals of a lower fusion point it is advisable to fit some kind of water-cooled wall. With this class of burner nearly all the air enters *via* the burner, and therefore little is added to cool the refractory walls or chill the ash. Nearly all furnaces installed in America carry some kind of water-cooled walls, and a number of complete water-cooled furnaces are in operation. The furnace bottom is either of the dry bottom type, in which the ash is easily removed, or of the wet type in which the ash is broken up by water or steam sprays. In other cases the furnace is kept hot and the ash is removed in a liquid state by a slag tap. A particularly interesting point is brought out in one case where the same company owns plant served by the unit and by the central system. The variation in coal in this particular plant, especially in moisture content, has a marked influence on the unit-fired boilers. Uneven coal feeding and difficulty in milling wet coal cause wide variations in mill output and fineness. The storage-system boilers show an equal steadiness with wet or dry coal, the intervening equipment between the mill and the boilers damping out milling variations. Mills up to 20-25 tons per hour are now being installed, and the wearing parts have a life of between 13,000 and 40,000 tons, varying widely owing to the different qualities of coal used. It is pointed out that fine pulverisation facilitates complete combustion in a minimum of time, and also prevents the formation of hard slag on the boiler tubes. The average boiler efficiency in several large stations is from 88 to 89 per cent., and there is little to choose in this respect between the unit and central systems.

In England there is approximately 1,121,043 sq. ft. of boiler heating surface being served by pulverised fuel with the central system of firing; this, however, includes plants that have been contracted for and have not actually started up. The central preparation system claims 26,835 sq. ft. and the unit system 99,351 sq. ft. The efficiencies obtained vary between 86 and 88 per cent. in many cases, 4 per cent. higher than the guaranteed figure. One of the most important contracts obtained during the year was an extension of the boiler plant of the Synthetic Ammonia and Nitrate, Ltd.; six new boilers are being laid down with the latest improvements, designed for 800 lb. per sq. in., and a final superheat of 840 deg. F. The boilers are capable of dealing with 269,000 lb. per hour and are fitted with water walls, except in the front where the burners are installed.

A Radio-echo Machine.

Dr. E. F. W. Alexanderson, of the American General Electric Co., addressing the International Civil Aeronautics Conference in the United States, claimed to have devised apparatus which will dispatch a wireless wave from an aeroplane to the ground and, by the speed of its rebound, indicate to the airman with the aid of coloured lamps on the dashboard the height of his machine. A mechanical attachment for use at 10 or 15 ft. will indicate in a similar way when to begin landing with safety in darkness or fog.

Industrial Electric Heating Exhibition.

A demonstration of the most modern applications of electric heat to industrial purposes.

ON Monday last an exhibition and a series of demonstrations of industrial electric heating apparatus was opened at Belle Vue, Manchester, and remains open until to-morrow. The exhibition has been organised by the Industrial Electric Heating Committee of the British Electrical Development Association, Inc., in collaboration with the Electricity Departments of the Corporations of Manchester and Salford, and the Lancashire Electric Power Co., Ltd. Most of the leading firms engaged in this branch of the industry are represented, and several of the furnaces, ovens, &c., are shown in operation. A similar exhibition was held at Poplar a year ago, in which eleven companies took part; on this occasion the number has risen to 14.

The ELECTRIC FURNACE CO., LTD., is showing the body of a one-ton "Ajax-Northrup" high-frequency furnace, which is claimed to be by far the largest steel furnace of this type in existence, previous examples having had a capacity of about 5 cwt. This furnace, which will be equipped with a high-frequency motor-generator of 650 kW, will shortly be in operation in France; the whole of the plant has been designed and built in this country. The same company is showing in operation a 3-kW high-frequency furnace—the smallest commercial pattern. Other exhibits are an electric air heater, suitable for core drying and similar purposes, and samples of the products of furnaces installed by the company; these include pottery from the largest electric pottery kiln yet built—a 115-ft., double-track, tunnel kiln, recently erected at Messrs. Doulton's works at Burslem—which, we understand, is giving exceptionally good results as regards both cost of operation and quality of product. Specimens of high-speed steel of higher quality than that produced in crucible furnaces; small cobalt steel castings; and various nickel and nickel-chromium alloys are also shown.

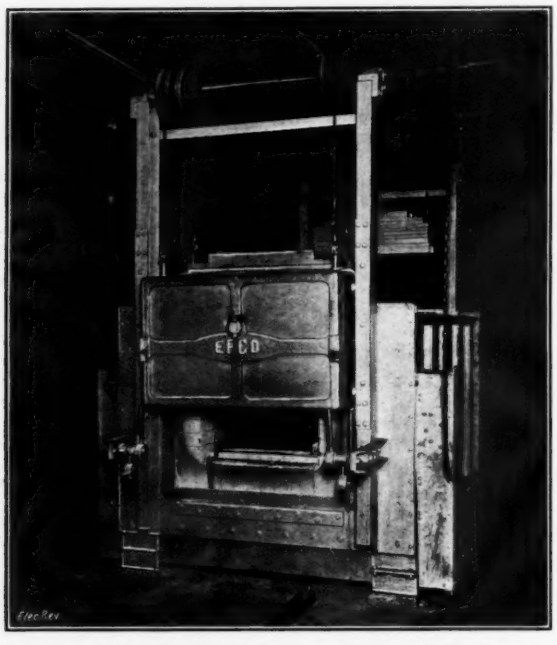


Fig. 1.—Gold-annealing Furnace; Electric Furnace Co.

Fig. 1 shows a 27-kW furnace by this company, which is designed for annealing gold and gold-plated strip and sheet.

Included in the display by the GENERAL ELECTRIC CO., LTD., is an 8-kW furnace having a chamber approximately 18 in. long by 12 in. wide by 10 in. high, and a maximum working temperature of 950 deg. C. A 30-kW furnace is also being shown. This has a chamber 21 in. wide by 44 in. long by 17 in. high. It is designed for use in the annealing of metals and for similar processes requiring temperatures up to 1,000 deg. C. Another exhibit on this stand is a small electric japanning oven specially suitable for garages and similar establishments. A "Magnet" air heater on show consists of a bank of elements enclosed in a box-like structure through which air is drawn by an extractor fan and distributed for heating buildings, &c.; it has a maximum loading of 7 kW. Other G.E.C. items include a 2-kW wax tank, having three-heat control; a 1-kW oil-pipe heater, incorporating an element specially adapted for clamping round pipes; a conforming steamer for hats, fig. 2, designed for steaming felt

Fig. 2.—Electric Conforming Steamer for Hats; G.E.C.

in the process of shaping; and a 4-kW water still, which will deliver one gallon of distilled water per hour. A standard "Magnet" single-deck baking oven with a loading of 18 kW is another feature of the G.E.C. display.

The BIRMINGHAM ELECTRIC FURNACES, LTD., exhibit two of their standard portable furnaces, out of a range extending from 8 to 40 kW. The smaller one, Model CP.1, fig. 3, is a single-phase furnace with a hearth measuring 20 by 12 inches—shown in use, hardening motor-car parts; the larger is Model CP.4, taking from 25 to 27 kW at 440 V, three-phase, with a hearth 36 by 24 inches. Photographs of installations of the company's larger furnaces are shown. The portable furnace consists of a welded steel cylinder lined with refractory and insulating material; the hearth, however, is flat, and is covered with nickel-chromium sheet, the result being a remarkably even distribution of heat. The heating elements are of heavy nickel-chromium strip, mounted in the roof,

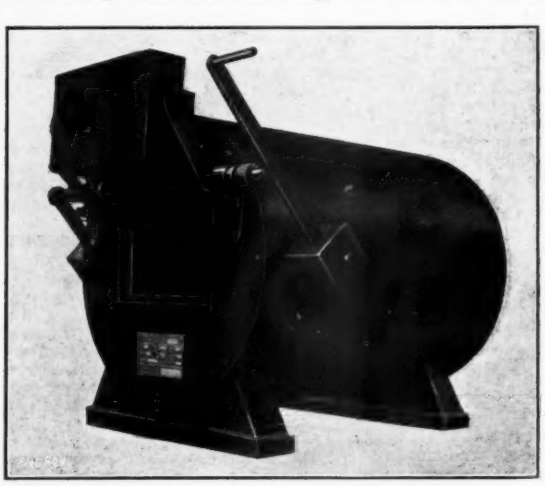


Fig. 3.—"Birlec" Portable Electric Furnace, Model CP.1.

sides, and hearth of the furnace, and protected with nickel-chromium sheet, which permits the heat to pass freely without overheating the elements. "Sil-o-Cel" insulation is used. The door has a patent parallel motion, closing tight without clamping, and is lined with refractory covered with nickel-chromium sheet; opening the door cuts off the current. Automatic control is fitted as standard, maintaining any desired temperature up to 1,000 deg. C.

(To be continued.)

Electrical Advertising Signs.

A Survey of some of the Factors Underlying the Successful Use of Electric Lamps in Advertising.

By H. LINGARD.

(*Abstract of a Paper read before the* ILLUMINATING ENGINEERING SOCIETY.)

DURING the last few years advertising as the silent sales force, and electrical advertising as the most effective and spectacular form of advertising, have correspondingly attained a more prominent position in the manifold activities of commerce.

The restrictions imposed upon electrical advertisers by local authorities have undoubtedly retarded progress to an enormous extent, and development is still severely handicapped by out-of-date legislation. On the other hand, it must be conceded that these same restrictions have had a certain beneficial effect in eliminating crude and annoying forms of electrical advertising.

Broadly speaking, it is possible to classify electric signs which are used out-of-doors into two classes, "long-range" and "short-range" signs, and the fundamental factors which affect design are somewhat different for the two types. Irradiation plays an important part in the designing and effective operation of all signs employing exposed-lamp construction, since, unless this factor is taken into account, the sign is liable to lose either legibility or appeal throughout the range of its viewing distance.

The effect of irradiation in the case of luminous objects, such as electric lamps, is accentuated or modified by various conditions. The greater the viewing distance the greater is the apparent magnification of the light source. The higher the power of the lamp the greater is the irradiation obtained. The effect of bright luminous sources in the immediate vicinity of one under direct consideration is to diminish the irradiation obtained.

The contrast afforded between the light source and its background also exerts an influence upon the irradiation produced, the effect being at a maximum when the immediate background is absolutely black, while even small increases in the background brightness will result in considerable reductions in the irradiation effect.

The general brightness of the surrounding district, taking into account the street and shop lighting and all other forms of illumination which are competitive to the electric sign, also influence the irradiation, which is at a maximum when the competing illumination is absent.

The correct spacing of lamps in any given sign, in order to obtain the best results at both maximum and minimum viewing distances, will naturally depend, in the case of long-range signs, on the amount of irradiation which can be obtained, since it is always the aim of the sign designer to obtain, as far as possible, a continuous line of light.

It is always important, however, for the designer to bear in mind that the sign must be designed for good legibility at the minimum viewing distance as well as at the maximum distance, and the range of distances within the area of effectiveness are obviously those which should receive prime consideration when designing for legibility and appeal.

The size of lettering most suitable for use in exposed-lamp signs will obviously depend upon the maximum viewing distance at which legibility is desirable. The effective legible range of any sign is dependent to some extent upon the amount of irradiation obtained, since this phenomenon may easily bring about illegibility, due to the overlapping or confusion of letter strokes. A rough method of obtaining the minimum letter height which has been found satisfactory in practice is to divide the maximum viewing distance by 250. This will give a letter height of 4 feet where the maximum viewing distance is 1,000 feet.

Apart from the influence of district brightness on irradiation in the case of signs which are viewed from considerable distances, the computation of total luminous output of the sign will be influenced by the competitive illumination, and where extremely bright surroundings exist, or where the sign will be called upon to compete with other bright signs in the vicinity, the wattage must be increased to ensure the sign having the necessary advertising value. Under these conditions it is difficult to lay down any hard-and-fast rules for the computation of total wattage in any sign, but where the competition is considerable the wattage must be increased over and above the figures obtained from the ordinary methods of design, while, in addition, many other methods of obtaining distinction and attraction, such as the use of contrast colours or simulated motion, obviously can be resorted to, and frequently will be laid down as definite requirements by the advertiser before the sign is designed.

A graphical method for the design of exposed-lamp signs has been developed by Messrs. W. C. Brown and F. E. Carlson.

It is necessary, in the first place, to classify the districts in which a sign may be displayed in order to ascertain the district brightness factor. Table I shows the classification of districts adopted for British conditions.

TABLE I.

DISTRICT LIGHTING FACTORS.

Description of District.	Factors.
Very bright centres in large cities such as Piccadilly Circus, Leicester Square, &c.	1
Main streets in fairly large cities and well lighted shopping centres	2
Centres of smaller towns and suburban districts ...	3
Isolated displays with no appreciable competitive lighting	4

To estimate the effect of the background brightness and the total wattage of the sign to enable the design to be carried out on a graphical basis, an intermediate factor designated "brightness index" (BI) must be employed, which will vary for different district brightness factors, and also with the total number of lamps in the sign. It is necessary, therefore, to make some rough estimate of the total number of lamps required, but some degree of inaccuracy in this calculation is not serious, as it will be eliminated by final recalculation. It is necessary to estimate the minimum letter height to enable complete legibility at the maximum viewing distance. The desirable lamp spacing for giving a continuous line of light should be based on the minimum viewing distance.

Total Number of Lamps.—Having obtained the letter height and lamp spacing necessary, the number of lamps in the sign can then be found by the following equation: No. of lamps = (letter height, in./lamp spacing, in.) × 2½ × no. of letters. The total number of lamps found by this calculation will and may necessitate a recalculation to obtain the final result.

The method of predetermining the night appearance to the average eye of a proposed display at some specific viewing distance, "spot study," may be found of use in the design of exposed-lamp signs. Spot studies may be made by the use of confetti pasted on black paper. A sketch should be made up to such size that when the confetti is pasted on the outlines of the letters or figures the result is a clear picture. The confetti will bear some scale relation to the estimated apparent diameter of the lamps under the given conditions. The diagram should then be viewed at a distance which bears the same scale relation to the maximum viewing distance of the sign, and the result will indicate approximately the appearance of the actual installation.

Probably the most important requirement of all in connection with the short-distance sign is that it should be of good appearance both by night and by day, since it is usually mounted on the front surface of the building, and must not in any way detract from or spoil the architectural features.

The popularity of the enclosed-lamp sign is due, in a large measure, to its more pleasing daytime appearance when compared with the exposed-lamp type of sign. The smooth even lines of the strokes of the pattern also lend themselves to building architecture which is quiet and dignified. It is a general rule not to employ enclosed-lamp construction for signs whose letters exceed 18 in. in height, while exposed-lamp signs to be satisfactory should not be used for signs with smaller than 18-in. lettering.

The minimum letter height which should be used in enclosed-lamp signs can be obtained approximately from the following equation: Letter height in feet = maximum viewing distance in feet/250, but this figure should only be adopted after careful consideration of the appearance presented by letters of such a size when viewed from short distances. The chief requirement from a lighting point of view in enclosed-lamp signs is that the luminous surface should be evenly and sufficiently lighted, and it is obviously possible to obtain the desired effect by a number of different lamp arrangements. It is, however, desirable to take advantage of the higher efficiency obtained from the larger lamps by using the highest wattage lamp that can be employed without seriously impairing the brightness uniformity of the luminous surface.

An enormous field of application exists for the types of signs discussed under the preceding headings for short-distance viewing, since the majority of enterprising shopkeepers, once convinced of the value of illuminating their fascia, will be only too anxious to employ the most effective and arresting of all methods, namely, that of using some form of electric sign. Correctly designed trough fittings over the top of the exist-

ing fascia will give adequate illumination under average conditions if provided with one 40-watt lamp per foot run, and if the fascia lettering is of the raised type the effect may be quite pleasing, provided that the light from the troughing is carefully screened from the eyes of passers-by. A development of this system has been made in one type of fascia-lighting unit which, by the ingenious use of curved plate glass over the fascia lettering, ensures that even illumination is provided from top to bottom of the fascia, thus eliminating the inevitable drop in brightness that occurs on the lower section of such installations when ordinary systems of top lighting are employed. Almost every variety of enclosed-lamp sign can be adapted for fascia-lighting work, the most important considerations being that the sign should have the minimum extension from the building surface, and should have a first-class daylight appearance. For enclosed-lamp fascia signs to have the necessary appeal it is recommended that at least one 40-watt lamp per letter should be employed.

Silhouette signs are also admirably suited to this class of work, presenting, as they do, such excellent daylight appearances, while the ready accessibility of the lamps provided in these signs undoubtedly appeals to the average retailer.

Radio Transmitting Aerials.

The Technical Aspect of the Design of Broadcast Radio-Telephone Radiating Aerials.

By P. P. ECKERSLEY, M.I.E.E., T. L. ECKERSLEY, B.A., B.Sc., and H. L. KIRKE.

(*Extracts from Paper read before the* WIRELESS SECTION *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

THE proper method of attacking the problem of mutual interference between stations and the all too limited service area of stations is to attempt to design an aerial so as, ideally, to make it a radiator which only produces a direct ray, or ground ray, *i.e.*, initially parallel to the earth's surface. It is the existence of the indirect ray which produces all the difficulties inherent to the production of a good broadcasting service, not only because it interferes with other very distant stations, but also because it produces fading and bad quality in the local-service area; further, all energy radiated upwards is, in broadcasting, lost. A high aerial with small current is the most efficient, *i.e.*, less power is required to produce a given value of metre-amperes. If all the aerial energy could be directed to produce the type of radiation desired, some interference might be expected, but at a skip distance, not everywhere as at present. Thus the first part of the paper deals with the theory of the aerial as a radiator of the type needed, and includes an account of full-scale experiments with different types designed to achieve the desired result, supported by a kite balloon hired from the Air Ministry by the British Broadcasting Corporation.

The outstanding fact that emerged from the experimental verification of the theoretical analysis is that high aerials appear to be necessary, but their use implies high masts, which are costly.

The wave-band allocated for broadcasting is approximately between 550 and 200 m., or roughly 1,800 to 650 ft., which entails masts for supporting $\frac{1}{4}\lambda$ aerials of from 900 to 325 ft. high, or, allowing for sag, 1,000 to 400 ft.

Assuming that two $\frac{1}{4}\lambda$ aerials could be used, masts 2,000 to 750 ft. high would be required; mechanical and economic conditions, however, impose a limitation of, say, 800 ft. for the highest mast. This means that Franklin aerials cannot be used for wave-lengths greater than about 700 ft. (213 m.), but that $\frac{1}{4}\lambda$ aerials can be used for most wave-lengths. Masts are extremely costly, and the point at issue is: with a given height of mast, what is the best form of aerial? The importance of obtaining a maximum ground ray and minimum indirect ray would seem to override all questions of economics, and only the mechanical limits of mast height (or prohibition by flying authorities) should set a barrier between the ideal and the actual. Nevertheless, owing to mechanical limits masts will always be shorter than is theoretically desirable. Thus, as a compromise arrangement, at this stage and without experimental verification, it would appear best so to arrange a T aerial that the current in the vertical part is the maximum at the greatest possible height from the earth. Care must, however, be taken to see that the ends of the horizontal part of the top hamper are not brought so near to the masts as to induce mast currents and so produce shielding and/or loss; the whole question is not significant if h is less than $\frac{1}{4}\lambda$, when h is the physical height of the vertical part of the aerial and λ is the wave-length.

It is pertinent to ask whether the masts could not themselves be used as aerials; the authors, after consideration, believe that, although at first sight attractive, the method is not to be recommended as sound engineering practice, chiefly because of the entire lack of flexibility. Wave-lengths change from year to year, and any broadcasting organisation

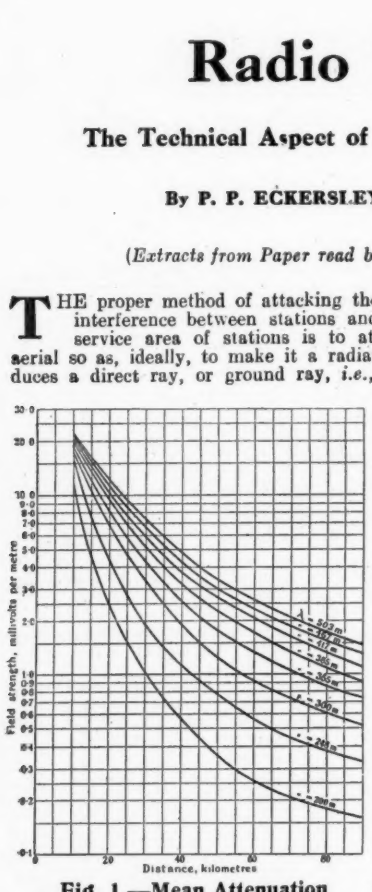


Fig. 1.—Mean Attenuation Curves.

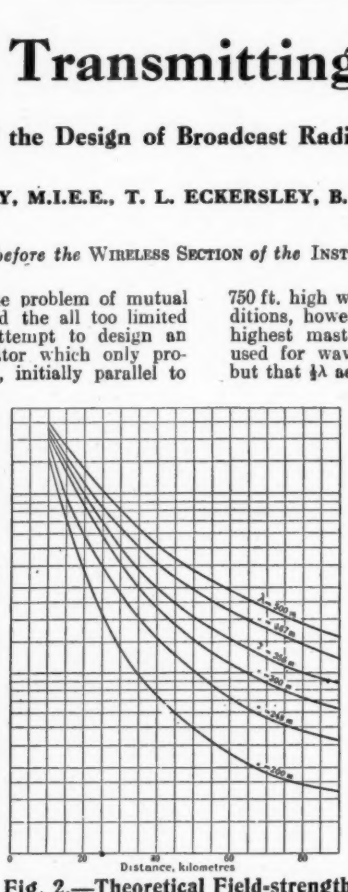


Fig. 2.—Theoretical Field-strength Curves.

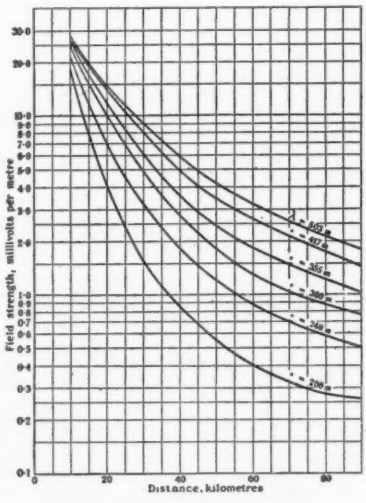


Fig. 3.—Theoretical Field-strength Curves.

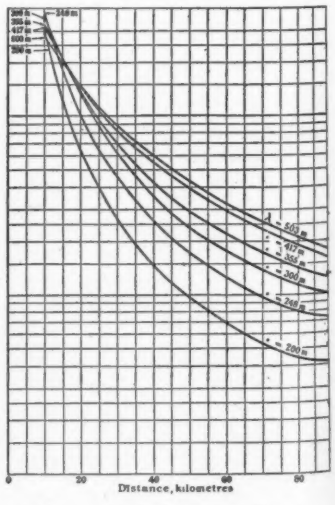


Fig. 4.—Family of Field-strength Curves.

finding itself forced to particular waves for certain stations might suffer. We must realise that high insulated masts are not easy to construct mechanically, and that an electric as well as a mechanical strain on the insulator might bring disaster. The effect of the stays is incalculable and might be deleterious. Wooden masts with a conducting core are attractive in theory, but always present the risk of fire; further, the life of such masts might be short and their cost for great height greatly in excess of that of steel masts. If, however, dual masts carrying the conventional type of aerial are to be used, it is particularly important to guarantee that they will not cast shadows of a serious nature. This trouble has been acute at the Daventry broadcasting station and a repetition of the difficulties would be foolish; it is therefore imperative to insulate the mast. It is suggested that the masts could be tuned to have a natural wave-length, when unearthed, equal to the wave-length used, so that no current would flow in the mast when earthed.

The second section of the paper deals with the theory of attenuation of waves of frequencies between 500 and 1,500 kilocycles per second; includes a complete set of curves actually obtained by the B.B.C. from a transmitting aerial near London, and data to enable one to specify in general terms the extent of service area and the effectiveness of the service to be expected when using a given power, frequency of emission of carrier wave, height of aerial, and earth conductivity.

The paper contains too little experimental verification of the theory outlined therein. A conclusion should, however, deal with generalities, and it is obvious from what has gone before that certain incontrovertible principles can, and should, be stated before more damage is done by organisations which appear to concentrate on an undignified scramble for the all too-limited facilities rather than thinking how best to use what are, in plain fact, the actual facilities available. The facts which emerge are:—

(1) The design of aerials for broadcasting should aim at using the energy to produce the strongest possible horizontal radiation, while diminishing upward radiation.

(2) To produce this desirable end, high aerials are a *sine qua non*.

(3) Nothing, however, that is done with special aerial design will prevent a serious limitation of service area, relative to that obtained with the longer waves, when the shorter waves are used.

(4) That, nevertheless, organisations must employ such waves, which are more efficiently used by the employment of high aerials.

Responsible technical authorities have in the past been chary of using waves below 300 m. for broadcasting because of their expectation that stations using such wave-lengths will have too limited a service area under practical conditions. This may be true in certain cases, but it is to be remembered that limitations are inevitable, and it is better to have a limited service than one which suffers continual interference. The use of shorter waves is perfectly economical in densely populated districts. It is hoped that the final analysis will help engineers to gauge the extent of the usefulness of all waves so that existing facilities may be most efficiently used. To this end we may combine theoretical analysis and the practical results set out in the foregoing. A set of curves is therefore reproduced which shows, at any rate to the right order of magnitude, the "effectiveness" of the different wave-lengths for the production of service area.

It is not easy to find a basis of comparison for the "effectiveness" of the various wave-lengths, as conditions of listening vary in different districts and areas. The point finally to be held in mind, however, is that the excellence of a service from a broadcasting station (apart from the quality of transmission, which is the same, practically speaking, for all wave-lengths) can only be judged by the degree of interruption experienced by the majority of listeners. It is for this reason that Capt. P. P. Eckersley defines service area in terms of signal strength alone, but points out that densely populated areas (where worse background noise exists) require a greater field strength than that necessary for rural districts, but both natural and man-made static diminish as the frequency to which the receiver is tuned becomes greater. The authors have therefore taken this factor of diminishing interference as being proportional to the square root of the frequency of the carrier wave.

The final analysis therefore is as follows:—

(1) A set of curves (fig. 1) for a $\frac{1}{4}\lambda$ aerial with 10 ohms dead loss for 1 kW *input* to the aerial.

(2) A set of curves (fig. 2) using a vertical aerial 400 ft high (500-ft. masts) having a constant dead loss of 10 ohms and 1 kW *input* to the aerial.

(3) A set of curves (fig. 3) with the above conditions, but with a vertical aerial 700 ft. high (800-ft. masts).

(4) The curves of fig. 3 are multiplied by a factor (proportional to $1/\sqrt{\lambda}$) to increase their apparent "effectiveness" as suffering less interference when the wave-length is shorter (see fig. 4); thus, using $\frac{1}{4}\lambda$ aerials, it requires, for a given service, say, 25 kW, but with 800-ft. masts this station, for the same service, can be run on 10 kW.

(5) The last set of curves (fig. 4) shows that the broadcasting engineer need not so greatly fear to use waves below 300 m., for the use of the shorter waves must come, and it is hoped that this paper may be of help to those who will one day have to use them.

The painstaking nature of this work cannot be over-emphasised; actually the field-strength measurer travelled 28,000 miles in the course of the investigations, and a tribute must be paid to the British Broadcasting Corporation's engineers and all those who participated in the tests, particularly many amateurs and Radio Research Board observers.

Transformer Breakdowns.

Report of a Meeting of the London Local Technical Group of the Electrical Power Engineers' Association.

AT a meeting of the London Local Technical Group of the Electrical Power Engineers' Association held on December 11th, Mr. S. Austen Stigant, M.I.E.E., read a paper on transformer breakdowns. A study of the records of modern transformer breakdowns over a period of years, he said, showed conclusively that between 70 and 80 per cent. of them were due finally to short-circuits between turns. Short-circuits between turns might result from abrasion of the insulation caused by the dislodging of, or shock to, one or more turns consequent upon an external short-circuit, or upon repeated unfavourable switching-in operations. In certain cases the trouble might not become apparent immediately, but should the transformer vibrate while on load, due to looseness of the core plates, core bolts, or core-clamping structure, the insulation would ultimately break down. Short-circuits between turns might also occur if the copper conductors had sharp edges which would chafe the insulation should the transformer vibrate on load, so bringing the copper conductors into contact. A source of danger was the use of square conductors on which the double cotton covering had not been tightly wrapped. In core-type transformers the mechanical stresses acted in a radial direction, and usually the conductors themselves were sufficiently strong to resist the bursting tendency set up under short-circuit conditions. If, however, the centres of the h.p. and l.p. coils did not coincide, an axial component of the stress was introduced which had the effect of forcing the conductors upwards and downwards in an axial direction. This tendency must be combated by providing rigid supports for the windings in an axial direction. In transformers with sandwiched windings the mechanical forces normally set in a radial direction, and also horizontally between high- and low-pressure coils, while if the centres of the h.p. and l.p. coils did not coincide, distorting forces were introduced.

Breakdowns due to transient voltage waves were discussed, and diagrams were exhibited to illustrate how the reflected and transmitted wave phenomena could be modified by the insertion of a protective condenser, or a protective choke coil, before the transformer.

Continuous excessive overloads always resulted in complete breakdowns sooner or later. The general characteristic of such breakdowns was the charring and carbonisation of the insulating fabric and the formation of hydrocarbon sludge deposits from the oil. The question of overload was intimately connected with the proper design of the internal cooling facilities (the oil ducts, &c.), and a case was on record of a transformer which, being badly designed from that point of view, burned itself out, even though subjected to quite a small overload for only a short period.

Discussing breakdowns in the magnetic circuit, Mr. Stigant said the breakdown of the insulation of the bolts inserted through the cores of core-type transformers for the purpose of clamping the laminations together, had the effect of short-circuiting the laminations themselves, producing in them local eddy currents; if, in addition, two or more of the core bolts broke down, heavy currents would circulate in the bolts, as they would form a short-circuited turn through which magnetic flux passed. Dealing with breakdowns due to magnetic-circuit characteristics, he discussed the switching-in current rush,

which was dependent mainly on the point of the pressure wave at which the transformer was switched in. If the transformer was switched in at the instant when the wave was passing through zero, the maximum current rush was obtained. Under certain conditions it was theoretically possible to switch a transformer in at the instant of zero voltage without any current rush occurring, *i.e.*, if the core possessed residual magnetism equal to and of the same polarity as the normal induction, the initial flux waves would follow their normal course and there would be no current rush.

Dealing with the oil used with oil-immersed transformers, Mr. Stigant said it was impossible to give too much attention to the question of moisture in oil, as innumerable transformer breakdowns had definitely been traced to that cause. Photographs were shown of transformers in which extensive sludging had occurred, and they demonstrated the importance of providing substantial oil ducts and of designing the supporting structure so that free circulation of the oil was not impeded. Reference was also made to the breakdown of insulating cylinders between high- and low-pressure windings, and also of insulating washers from the windings to ground. The breakdown of these was due often to some flaw in manufacture, which usually took the form of, either the inclusion of air between the paper layers or some contamination of the surface.

Finally, Mr. Stigant emphasised that it was only by thorough, careful and common-sense inspection that the majority of, if not all, faults could be eliminated.

Discussion.

Mr. WALLIS asked if efforts had been made to produce an apparatus which would ensure switching off a transformer at precisely the correct time. He had in mind Constantinesco's system of shooting bullets through the revolving blades of an aeroplane propeller; perhaps switching could be arranged only when the flux was at its right density.

Mr. STIGANT said he believed such an arrangement had been made in the laboratory at Liverpool University, but to his knowledge it had never been applied in practice.

Mr. HENDERSON said that the large percentage of breakdowns which had been due to short-circuits between turns seemed to indicate carelessness in inspection; there was no doubt that success in transformer work, particularly when dealing with high voltages, depended to a very large extent upon continuous supervision throughout the process of winding. He asked if Mr. Stigant still favoured the use of wooden packing blocks between coils, and what was the nature of the insulation reinforcing material he used at the beginnings of the windings.

Mr. STIGANT said that provided the wood was thoroughly dried and impregnated, it was satisfactory for supporting the tops and bottoms of the coils of concentric circular windings for core-type transformers, but for high-voltage transformers he would not use it.

Mr. HENDERSON, referring to the statement that the oil temperature should not exceed 90 deg. C., pointed out that local heating might occur. Mr. STIGANT replied that 90 deg. C. was usually specified as the maximum temperature in the hottest layers of the oil, *i.e.*, the top layers, and that was where the temperature was usually measured. In a properly-designed transformer, 90 deg. C. was the highest oil temperature.

Mr. PARR asked if Mr. Stigant considered that buffer resistances should be fitted to high-pressure switches invariably for switching in transformers, and whether they would be burned out as the result of a big rush of current. Mr. STIGANT said there was no need whatever for equipping switches with buffer resistances indiscriminately. They had been somewhat prevalent many years ago, but it must be admitted that in many cases they had fallen into disrepute.

Mr. BRETTLE asked if there existed any reliable protective gear to guard against short circuits between turns. The author replied that a certain type of protective gear which had been patented, but not put into practical operation, had one of the windings split into two parts and connected in parallel through suitable current transformers. Under normal conditions the inductive effects of each of these halves with respect to the other winding were equal, but if a fault between turns occurred on one of the halves, or on the winding which was not split, that inductive equality was upset.

Mr. SKINNER, referring to the method of testing the dielectric properties of oils by transmitting current at increasing pressure between two small spheres in a small sample of oil, asked whether the voltage at which the initial sparking occurred, or that at which the final breakdown occurred, was the criterion of breakdown voltage. Mr. STIGANT replied that the voltage at which final breakdown occurred was regarded as the breakdown voltage, and that could be determined visually by reason of the very heavy and continuous discharge or flash-over between the two spheres.

Mr. HILLING asked if the author would advocate the use of a non-sludging type of oil in a kiosk transformer, and what precautions he would take to ensure that samples of oil drawn off for test when the transformer was running were not contaminated. It was replied that in British Standard Specification No. 148 it was stated that a certain grade of oil should not be used where temperatures of more than 75 or 80 deg. C. were reached, and the non-sludging grade was recommended for temperatures above that up to 90 deg. C. It depended entirely on the temperature at which the transformer was to be operated.

Mr. D. A. S. PORTEOUS said that although the effect of protective reactance might be the same as that of protective capacity, he had always understood that it was considerably easier to obtain the necessary protection by means of capacities than by reactances. He asked what were the relative costs of affording protection by each of these two methods. He understood that a very good method of protecting the transformer was to introduce a fairly long length of cable between the overhead line and the transformer. Mr. STIGANT said it was much more expensive to install protective condensers than protective choke coils. The practice of introducing a length of cable between the line and the transformer was initiated, he believed, by the engineers on the north-east coast, and the number of failures that occurred in various parts of the system had been reduced to a very small fraction of the number that had occurred previously.

The Chairman, Mr. W. J. OSWALD, referring to the use of wood for packing and insulating purposes, said he had wondered whether the material as used was really wood. In the first place, wood was thoroughly dried and placed in a vacuum; what remained was a cellular mass into which insulating material was then introduced and compressed, the pressures to which it was subjected being fairly heavy. Mr. STIGANT replied that there were certain interests endeavouring to push the use of wood, or, rather, endeavouring to sell varnish, and it was claimed that the impregnation of the wood with the varnish so improved the qualities of the wood as to make it suitable for extra-high-pressure work. He would have no hesitation in using it for transformers up to 11,000 volts, but would be very chary of using it for the insulation of transformers for higher voltages.

Mr. STRETTON asked whether, in the event of a large bank of water-cooled transformers having to be operated for a short period with the water shut off, the ascertainment of the temperature of the oil by means of a thermometer would give a good indication as to whether the transformers were being operated at a safe temperature. Mr. STIGANT said it was probable that, providing the oil temperature was not allowed to exceed the oil temperature specified for self-cooled transformers, it would give a reasonably safe indication of the maximum permissible loading of the transformer. It had to be borne in mind, however, that when artificially-cooled transformers were operated as self-cooled units the internal temperatures might be slightly higher than those in a transformer designed only as a self-cooling unit.

Legal.

Thefts of Electricity.

AT the Thorne (Yorks.) Police Court recently, George Merrick, a miner, was charged with having fraudulently abstracted electricity from the mains of the Electrical Distribution of Yorkshire, Ltd., by inserting filed copper coins in a shilling-in-the-slot meter and for stealing money from meters belonging to the company. He was found guilty and sentenced to two months' imprisonment and fined £3, or in default a further month's imprisonment.

Another miner, John Bristow, who pleaded guilty to a charge of obtaining electricity by putting buttons in a slot meter, was fined 40s.

A representative of the company stated that the slot-meter system was being so badly abused that the company would have to abandon it if the conditions continued.

AT the Brighton Police Court on January 2nd, Capt. John Crowe, V.C., was charged at the instance of the Corporation with the fraudulent consumption of electricity. A Corporation inspector said that he found that the defendant had installed temporary wiring, by means of which he obtained electricity for lighting from the power circuit.

The defendant denied that he had habitually obtained light in this way. He said that he wished to charge accumulators in a dark place and merely fitted up a temporary arrangement to give him the necessary light. The magistrates imposed a fine of £5, or, in default, 21 days' imprisonment.

Overhead Lines and Road Widening.

A point of considerable importance is associated with the granting of a Special Order to the Dawlish Electric Light Company to supply electricity in the parishes of Kenton and Starcross, Dawlish West, Ashcombe, and Mainhead. At the recent inquiry the application was opposed by the Devon County Council for the purpose of securing the insertion in the Order of a clause providing that in the case of any road widening the Company should be responsible for removing and re-erecting the electric poles or standards. This clause was resisted by the Company, which has been granted the Order without its inclusion therein.

Rural Electrification in South Australia.

Notes from a Report in the Quarterly Bulletin of the Institution of Engineers, Australia, of the Retiring Chairman's Address to the Annual General Meeting of the Adelaide Division.

By J. R. BROOKMAN, M.E., M.I.E.Aust.

THE problem of rural electrification lay in the length of line required to supply each individual consumer, and the necessity of keeping the capital expenditure down in order that the limited revenue available might provide a reasonable return on the expenditure. The first movement in the direction of rural supply in South Australia was made about 1912, when supply was given by the Adelaide Electric Supply Co. to some market gardens in Campbelltown for pumping water for irrigation purposes. In order to cut the cost of construction down as much as possible, the company put up high-pressure lines overhead, and developed a cheap type of overhead transformer station These economies had the desired effect, and rapid progress was made. In 1922 the whole of the pumping in the Torrens Valley, from Athelstone to Fulham, was done by electricity. In 1926 the Adelaide Company purchased the undertaking of the Mount Barker Electric Supply Co., and to connect it a 33,000-V line was built from Piccadilly, giving supply *en route* to Aldgate, Bridgewater and Ambleside, and an extension was also made through Littlehampton to Nairne. The bulk of the power load connected on this line was of a different class from that previously mentioned, including, as it did, brick yards, bacon factories and a flour mill.

Generally speaking, the pole lines were taken along the roadways, but in some cases it was found necessary to traverse private property and follow the stream from which the gardeners obtained their water. No attempt was made to obtain easements for these lines, written permission being accepted as sufficient authority. It had been found that an attempt to obtain an easement endorsed on the title of a property often aroused the strenuous opposition of the owner, or induced extravagant demands for compensation. The company relied on the fact that electricity was essential to the gardeners and that electricity supply on a property enhanced its value. Where main transmission lines were concerned, easements were obtained, or properties were purchased outright. As a *quid pro quo* for these permissions, the company agreed, instead of making the usual charge for the whole of the service lines required to serve the owner's house and motors, to allow him free one pole per horse power of motors, and one pole per house, any excess length being charged at so much per yard. The disadvantage of this scheme was that the owner was liable to put in an oversize motor in order to get an extra pole or two free, which reacted unfavourably on the power factor of the supply, but otherwise it was most successful. The power factor of rural supply was, however, generally poor, and in this case was not much better than 50 per cent. The irrigation business was attractive because it was an "off peak" load, promptly shutting down when the clouds began to gather, thus leaving the power house free to supply the lighting which was then called for in shops, offices and factories. As a summer load it helped to even up the difference between the summer and winter loads caused by office radiators.

The Adelaide Electric Supply Co.'s rural power consumers totalled about 450, with 3,400 h.p. of motors connected, resulting in a revenue of £10,000 per annum. In addition to this, their household requirements would account for another £3,000 per annum. There was also a large number of consumers along the rural distribution lines requiring electricity for household purposes only, who added considerably to the revenue. Having acquired the electrical plant of the Gawler Corporation in 1923, and connected it by a 33,000-V transmission line from Port Adelaide, the Adelaide Electric Supply Co. was in a position to consider giving a supply to Freeling, Nuriootpa, Angaston and Kapunda. Requiring as it did about 40 miles of 33,000-V transmission line, the chief difficulty was to keep the expenditure down to a figure which would permit energy to be supplied at a reasonable rate. Fortunately, at that time, Mr. J. C. Stobie, A.M.I.E.Aust., came forward with his proposal for the steel and concrete pole, which he had since patented (ELECTRICAL REVIEW, September 18th, 1925, p. 453). By adopting this pole, and using spans of 600 ft. instead of 250 ft., costs were brought down to the required figure.

The work was then put in hand, including also a 36-mile line to Balaklava. The latter had been since extended through Blyth, Brinkworth, Georgetown, Gladstone, Caltowie to Jamestown, a route length of 100 miles from Adelaide. The latter extensions could not be strictly classified as "rural," as up to that time no attempt had been made to take the supply beyond the limits of the townships, but in Angaston and Nuriootpa there was a small amount of pumping load, and the wineries were using electricity for grape crushing, cellar lighting and wine pumping. Similar conditions applied along the 30-mile line recently constructed through Reynella to McLaren Vale and Willunga. There was, however, a branch line six miles long through McLaren Flat, a district largely devoted to fruit growing, where motors were used for irrigation purposes.

Those long country lines were operated at 33,000 V, and could not be used for local supply *en route* on account of the cost of the transformers and switchgear which would be necessary. The step-down stations, however, for the supply of the country towns which occurred at intervals of roughly 12 miles, along the line, provided suitable jumping off points for possible rural distribution lines to the surrounding farms. The problem that yet remained to be solved was how to supply the farms. The great difficulty lay in the scattered nature of the load. Whereas the market gardener might have a property comprising anything from 5 to 50 acres, the average farm was probably of about 800 acres. The length of line required to supply the gardener averaged one-quarter mile per consumer, while that to supply the farmer was over a mile. The power requirements of the farmer were small, bringing in not more than one-third of the revenue obtained from the average market gardener. If the farmer could be persuaded to do his cooking electrically, and put in a hot-water system and refrigerator, the revenue obtainable would still not justify any great extension. In all electrical undertakings it was found that there was a definite maximum ratio, usually about 3 or 4 to 1, between the capital which might be spent on an extension and the revenue to be derived from it, in order that it might return sufficient to meet interest, maintenance, and depreciation charges on the investment.

It was found in South Australia, and confirmed by experience in America, that even if the farmer had an all-electric home, the supply undertaking could not afford to extend more than one-third of a mile if the extension was to be even barely payable. There were only two alternatives: (1) For the farmer to pay the cost of the line required to reach him, perhaps £250 to £350; (2) for the farmer to pay the interest, maintenance and depreciation charges on the extra length of line not covered by the revenue, amounting to, say, £30 to £40 per annum, in addition to the cost of energy.

The method which appeared to the Adelaide Electric Supply Co. to be most satisfactory to all parties was for the consumer to pay the capital cost of the extension, and in return receive a rebate of, say, from 15 to 20 per cent. on the cost of energy supplied to him, which was charged at the rates ruling in his particular local government area, or in the nearest township. This rebate was continued until his deposit was repaid. Other consumers connected to the extension who had not contributed to the deposit did not receive the rebate on their consumption, but it was distributed among those who had contributed. This plan had the advantage of stimulating the use of electricity in order to secure the return of capital, and made the contributing consumers keen on getting as many as possible of their neighbours connected.

Correspondence.

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession.

Bottom or Side Heat?

Your pointed editorial note *re* "The Design of Electric Ovens," referring to your contributor "A Station Engineer" is very opportune, and the article "Bottom or Side Heat" clearly illustrates that the subject of correct design should be seriously studied.

Unfortunately designers of electric ovens or cookers have taken the orthodox gas oven practice as the basis of correct design. Because gas burners are placed at the side of the oven, they locate exposed elements on the sides of the electric oven, using a baffle-plate to protect the element and distribute the heat. They have not taken full advantage of the flexibility of electricity for heating and cooking.

To add to the proofs of neglect of this particular application of electricity we have only to refer to the B.E.S.A. Glossary of Terms No. 205-1926. Sub-section 85 covers heating and cooking, with a ridiculously short list of 12 terms. If this is intended to be comprehensive, then it clearly indicates how little is actually known of the important field of electric heating and cooking.

A prominent member of the profession, during the discussion following the reading of my I.E.E. paper, "Large Electric Baking Ovens," stated that electric baking was a simple matter, following the lines of electric cooking. It is this indifference to the subject which must be taken as a veneer to cover actual ignorance It *may* be simple, but the present designs of cookers do not reflect much credit on the electrical industry.

Visiting an electrical showroom in a "Garden City" recently, I saw a range of cookers of a prominent firm's make. Reference was made to another well-known make of cooker, which produced the surprising information that a dozen or more had been installed, but were taken out after a few months' use and were packed away in the stores, having caused

a series of troubles. They are certainly not cheap cookers, consequently the design must be wrong.

Personally, I consider present-day practice all wrong. Designers should consider following the method employed in designing electric ovens as used by bakers; shallow ovens with elements outside the baking chamber, located above and below the baking chamber. It should not be necessary for the housewife, cook or whoever uses the cooker to continually stoop when attending to the article that is being baked, being literally choked when the door of the cooker is opened. American and Canadian designers have long recognised this disadvantage and build the cookers raised on legs of convenient height, a practice now being imitated by a few English manufacturers.

In the shallow type of oven as mentioned it is possible to bake everything perfectly. Joints, pastries, potatoes, fruit cake, scones, bread, &c., obtaining the required uniformity with variable top and bottom heat. Admittedly more floor space is required, but the space below the oven can be utilised economically.

"Station Engineer" is apparently doing a little bluffing when he refers to light packing of a woolly nature. He surely knows that this is slag wool. The criticism of this method of heat insulating is justified, as slag wool has a tendency to settle down, and this is accelerated by the continual shock due to closing the oven door. For the oven sides and back, block lagging is certainly the best. Slag wool can be used for the top and bottom if desired, but block lagging throughout is certainly the better job.

A reasonable air space between the lagging and the elements is desirable to permit equalising of the heat on top and below the baking chamber. An air space between the lagging and the outer casing is also an advantage.

The subject can be carried further, but I have already encroached too far on your valuable space. It is a pleasure to note your progressive attitude towards the practical applications of electricity, and it is to be hoped that, following your lead, the year 1929 will witness progressive attempts to deal with the problem of cooking and baking by electricity, so that a reliable set of standards can be made available. It is not sound progress to model designs on antiquated gas cookers.

W. Ellerd-Styles.

London, *January 1st*, 1929.

I was very interested in the remarks on "Bottom or Side Heat" by "A Station Engineer" in your issue of the 28th inst. May I be allowed to comment on his very interesting article?

As a practical cook with long years of experience with many makes of cookers, I should like to say that I agree with his views on the subject of "top and bottom heat."

At one time I was in favour of bottom and side, but since I have grown used to top and bottom, I have learned its economy and efficiency, and find the results good every time for all classes of cooking.

It is perfectly correct that in the North, where cooking is of a heavy type (and especially for bread baking), the best results are obtained where bottom heat is chiefly relied on.

As everyone knows, heat ascends and circulates; therefore, top heat is only required for occasional use. Here let me add that when the top element of the oven is used as a grill it is not only more economical, but also more efficient, and a new departure which is worthy of more consideration. An obvious advantage is that with the space available in the oven a considerably larger grill can be conveniently provided, which would enable a lunch of reasonable size to be grilled in one operation.

Again, a small ventilator in the oven is a great aid in keeping the oven lagging from condensation and causing steam in ovens.

Annie Mole.

London, *January 1st*, 1929.

Hire and Hire-purchase Schemes.

With reference to the report on page 33 of your issue dated the 4th instant, in reading through the remarks attributed to "Mr. Bryant, Hackney," I conclude that I failed to convey clearly precisely what I intended.

According to your report, my proposal was that cooker hire rentals should be raised from, say, 10s. to £1 per quarter, and the energy charged should be dropped from 1d. to, say, 0.6d. This, however, constitutes but a step in my argument. Obviously, such a comparatively enormous rental would almost completely stem the cooker hire business; but, in order to overcome this, I would issue the cooker installation on hire-purchase terms. Thus, the greatly increased charge would be, I submit, justified.

My argument is that under such conditions electric cooking would soon become established as being very cheap indeed, and, whilst the hire-purchase charge would be high, as compared with the hire charge, the consumer would, it is thought, be satisfied, inasmuch as ultimately he would become the owner of the apparatus. I have in mind that the hire-purchase period should be of the order of seven years.

I suggest that the life of a cooker of any reputable make is more or less indefinite, provided it be properly cared for. This proviso is an overwhelming factor in the hire of cookers. It is, I think, an established fact that hired apparatus is, more often than not, *not* properly cared for. If, however, the installation were on terms of hire-purchase, the hirer would probably, in view of the fact that he would be the ultimate possessor, take due care of it.

Furthermore, capricious applications for exchange of cookers, coupled with threats of final removal, would be largely eliminated for the reason that the hirer would feel that he had become so deeply committed in the transaction that he would not be likely to sacrifice the aggregate amount paid in respect of hire-purchase rental. Of course, the overall payments for hire plus energy in the average cases of hire and hire-purchase would be approximately the same, only the allocation being different.

In making my remarks at the meeting, I omitted to make mention of the fact that in connection with my proposals it was my intention that maintenance should be included, as is done in the case of plain hire, except that where the maintenance costs involved were disproportionately high a covering charge would be made.

The outstanding advantages of hire-purchase as opposed to plain hire appear to me to be that the supplier of the cooker is more reasonably secured in the transaction, whilst the consumer who makes abundant use of the supply is recompensed by the lower energy charge. Thus increased consumption is encouraged.

Edward Brown,
Sales Manager.

Electricity Department, Hackney.
January 7th, 1929.

Lamp Trading.

Mr. J. H. Noble once again raises the writer's point under the above heading, and I whole-heartedly agree with your correspondent in his grievance. Has this discount "business" not now developed into a cancerous growth so far as all things electrical are concerned? Lamps, plant, fittings are apparently sold to Tom, Dick, and Harry at discounts, sometimes better than those given to *bona-fide* electrical people. The *bona-fides* of the E.L.M.A. is, I believe, beyond reproach, but this Association cannot take any action against suspected people without absolute proof. It may seem strange that we contractors do not ask our tailor or shoemaker for discount on our purchases, the reason for this being that so many of us are on the point of retiring on our huge (?) profits in order to allow the large poverty-stricken (?) wholesale houses to carry on.

A. Milne.

Glasgow, *January 5th*, 1929.

Thermal Efficiency.

"M.I.Mech.E.'s" query in your issue of January 4th may be answered by the formula—

$$\text{Overall thermal efficiency} = \frac{\text{kWh dd. to outgoing feeders} \times 3{,}412 \times 100}{\text{B.th. units in coal consumed.}}$$

That is to say, the thermal efficiency of a power station is the ratio between the thermal units equivalent to the output (at 3,412 B.th. units per kWh) and the B.th. units in the coal consumed.

Assuming a case in which 2 lb. of 12,000-B.th.u. coal is consumed per kWh delivered to outgoing feeders, the overall efficiency will be—

$$\frac{3{,}412 \times 100}{2 \times 12{,}000} = 14.23\%.$$

M.Inst.C.E.

January 5th, 1929.

The Value of Technical Qualifications.

The writer of the article entitled "A Young Engineer Takes Stock" is much to be congratulated on earning a salary of apparently five to six pounds a week at 29, on having increased his salary steadily, on escaping unemployment—even in the dreadful post-war years, and having gained a considerable variety of experience. He is hard to please. As with thousands of others, I find my salary is less, in spite of exceptional technical attainments and some 10 years of varied experience, and I have had bad runs of unemployment.

Much reflection has driven me to the following conclusions:—

A salary of much over £5 per week is exceptional for young engineers (say, under 35) in the manufacturing side, and this is usually considered good.

There is no appreciable market for wide theoretical knowledge in young engineers such as may be gained in the four or five years day or evening schools. The industry is now so highly specialised that only routine jobs exist for young men, and the slight technical knowledge necessary can be imparted to untrained, but intelligent, men very easily.

That whilst a good training and a variety of experience

mean much expenditure of time, money, and comfort, they are of little commercial value.

Nothwithstanding the aspirations of fond parents and relations, and the demoralising character of modern thought and literature, a young engineer might well be content with, say, £5 to £6 per week if his job is not greatly exhausting or uncertain.

What do your readers think?

Disillusioned.

January 6th, 1929.

Price-cutting and Unfair Competition.

I am writing this letter to draw the attention of the trade (if that is necessary) to the constant price-cutting that is going on, especially by the big stores. These lines are also meant as a very strong protest against what is very unfair competition.

As an instance, one big store was recently offering in the Press "Oak or mahogany table standards, wired complete with flex, keyswitch holder, and parchment shade, at 6s. 11d. each."

Then, again, another store was advertising the "New Cossor melody-maker" at £6 15s., whereas the retail price is known to be £7 15s. The manufacturers themselves were advertising at the latter figure only last week, nearly two weeks after the store had offered the same thing at £1 less.

Now what chance does a retailer stand, when he relies on his trade discount to pay overhead charges? What confidence has anyone in the electrical industry (or any industry for that matter) to-day, that will encourage him to order goods for stock?

I suggest that the manufacturers are solely to blame, for selling to the stores at prices which enable them to undercut what is considered to be a fixed retail price for a given article.

I have heard manufacturers argue that the stores naturally get preferential terms, as they buy in large quantities. Whilst not agreeing with this justification, I suggest that they buy large quantities with the knowledge that they can easily dispose of them by undercutting. Why do the manufacturers allow this sort of thing? I know a few of them have put their backs up, and will not allow it.

I think the time is ripe when the trade should get together and insist that retail prices should be maintained to the public by refusing to supply any firm disregarding this ruling.

It is not a case of old stock being disposed of, as is proved by the instance of the wireless set above mentioned, which is known to be comparatively new. I know this question is a very large one, and I shall be on the look-out for any other comments of your readers.

S. L.

January 1st, 1929.

Published Specifications.

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specification will be printed and abridged and all subsequent proceedings will be taken.

1927.

15,620. "High-speed commutator switches in television apparatus." J. L. Baird and Television, Ltd. June 11th, 1927. (302,187.)

16,052. "Method of balancing telephone cables." Pirelli-General Cable Works, Ltd., and H. T. Werren. June 16th, 1927. (302,373.)

21,042. "Automatic or semi-automatic telephone systems." Associated Telephone & Telegraph Co., and J. Wicks. August 9th, 1927. (302,200.)

21,271. "Electrical conductors and cables." M. A. Bolton and J. W. Walker. August 12th, 1927. (302,202.)

23,197. "Electric radiator fires." S. Z. De Ferranti and Ferranti, Ltd. September 3rd, 1927. (Addition to 300,565.) (302,256.)

23,538. "Devices for transmuting the energy of visible light rays." I. E. McCabe. September 7th, 1926. (277,344.)

23,683. "Electromagnetic apparatus suitable for use as a relay, switch, motor, or like device." Creed & Co., Ltd., F. G. Creed, W. H. Storey, and R. D. Salmon. September 8th, 1927. (Cognate application 34,152/27.) (302,259.)

23,764. "Liquid-supply devices for electric batteries." J. D. Sartakoff. September 9th, 1927. (302,296.)

23,786. "Fire-alarm systems." Telefonaktiebolaget L. M. Ericsson. September 11th, 1926. (277,362.)

23,948. "Protective systems for electrical circuits." C. M. Longbottom. January 24th, 1927. (284,202.)

24,057. "Variable condensers." C. F. Burton and H. Burton. September 13th, 1927. (302,264.)

24,058. "Rheostats." C. F. Burton and H. Burton. September 13th, 1927. (302,298.)

24,168. "Call-finding arrangements in automatic telephone systems." Siemens Bros. & Co. Ltd., H. E. Humphries, and R. G. Dixon. September 14th, 1927. (302,301.)

24,219. "Ignition apparatus for internal-combustion engines." J. Lucas, Ltd., and E. G. Harris. September 14th, 1927. (302,302.)

24,317. "Electric arc-rectifier systems." British Thomson-Houston Co., Ltd., and J. C. Read. September 15th, 1927. (302,389.)

24,363. "Holders for thermionic valves." Collinson's Precision Screw Co., Ltd., and F. E. Collinson. September 15th, 1927. (302,392.)

24,471 "Electrical signalling or control systems." Aronwerke Elektrizitats Ges. and W. Stern. Seotember 16th, 1927. (302,396.)

24,522. "Insulation material for electrical apparatus." H. D. Symons. September 17th, 1927. (302,397.)

24,727. "Electrical terminals, contacts, or connectors." A. Kirk. September 20th, 1927. (302,405.)

24,777. "Thermionic-valve holders." G. A. Mathieu and S. B. Smith. September 20th, 1927. (302,407.)

24,781. "Fire-alarm systems." Automatic Telephone Manufacturing Co., Ltd. (C. E. Lomax). September 20th, 1927. (302,409.)

25,141. "Vacuum electric tube devices." E. Y. Robinson, E. J. E. Hubbard and Metropolitan-Vickers Electrical Co., Ltd. September 23rd, 1927. (302,418.)

25,498. "Electric relay arrangements." Relay Automatic Telephone Co., Ltd., F. W. Davis and F. A. Wilding. September 27th, 1927. (302,422.)

25,815. "Electric lighting systems for road vehicles." J. B. Saunderson. January 24th, 1928. (302,424.)

26,409. "Covers for joints in electric cables." Callender's Cable and Construction Co., Ltd., and A. E. Wilson. October 6th, 1927. (302,432.)

26,426. "Switches for electric circuits." L. Barrett. October 6th, 1927. (302,433.)

27,034. "Circuit arrangements in automatic and semi-automatic telephone systems." Siemens Bros. & Co., Ltd., and A. E. Caswell. October 12th, 1927. (302,441.)

28,073 "Cathodes for gas-discharge vessels." Siemens & Halske Akt. Ges. October 23rd, 1926. (279,497.)

29,190. "Cone-type loud-speakers." W. K. Webster. November 2nd, 1927. (302,459.)

29,866. "Electric switches and fittings therefor." J. Birch & Sons, Ltd., and C. Birch. November 8th, 1927. (302,463.)

30,090. "Electric motor generators." G. H. Fletcher, A. Tustin and Metropolitan-Vickers Electrical Co., Ltd. November 9th, 1927. (302,466.)

30,194. "Lids or covers for galvanic batteries." Oldham & Sons, Ltd., and W. D. Wilde. November 10th, 1927. (302,469.)

31,251. "Secondary or storage batteries." Chloride Electrical Storage Co., Ltd. (Electric Storage Battery Co.). November 21st, 1927. (302,472.)

31,276. "Direct-current excitation of synchronised asynchronous motors." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). November 21st, 1927. (302,473.)

31,284. "Method of and means for balancing cables and land lines, provided or not with compensating leads and earth cables." H. Tinsley and D. C. Gall. November 21st, 1927. (Addition to 262,991.) (302,474.)

31,798. "Automatic control switch for radio receiving apparatus." M. Fleischamann. November 27th, 1926. (281,330.)

32,111. "Apparatus for receiving transmitting, and amplifying high-frequency and low-frequency electrical currents." R. Deason. November 29th. 1927. (Cognate applications 6,405/28 and 6,406/28.) (302,482.)

32,156. "Construction of dynamo-electric machines." English Electric Co., Ltd., R. D. Ball and H. A. Brown. November 29th, 1927. (302,483.)

32,876. "Electrodes for indication and determination of the chemical composition of liquids." H. S. Hatfield. December 5th, 1927. (302,490.)

33,807. "Low-voltage continuous-current motors." A. V. Keller and B. F. Ancock. December 14th, 1927. (302,497.)

34,790. "Electrical switchgear." D. R. Davies and Metropolitan-Vickers Electrical Co., Ltd. December 22nd, 1927. (302,502.)

34,870. "Manufacture of cathodes for electric discharge tubes." M-O Valve Co., Ltd., and J. W. Ryde. December 23rd, 1927. (302,503.)

1928.

749. "Electrical insulators or the like." J. E. Pollak (Hermsdorf-Schomburg-Isolatoren Ges.). January 9th, 1928. (302,507.)

904. "Fuses, fuse boxes, or the like." Soc. C. Schneider et Cie. January 11th, 1927. (283,502.)

3,459. "Automatic multipolar toggle-lever electric switch." W. Leyhausen. February 4th, 1927. (284,716.)

3,976. "Shielding systems for electric discharge devices." British Thomson-Houston Co., Ltd. February 8th, 1927. (285,020.)

4,992. "Insulated electric conductors." Siemens Bros. & Co., Ltd., and A. E. Foster. February 17th, 1928. (302,522.)

5,644. "Electric motors." E. D. Feldman. February 22nd, 1928. (302,523.)

5,956. "Electrical switches." J. T. Welsh. March 2nd, 1927. (286,368.)

6,988. "Process for the manufacture of cathodes for discharge devices." Allgemeine Elektricitäts Ges. March 7th, 1927. (Addition to 268,815.) (286,650.)

8,203. "Manufacture of electric heating resistances." U. Elektro-Heiz Warme Ges. March 19th, 1927. (287,458.)

8,611. "Apparatus for heating rods, tubes, and the like by electricity." E. F. Northrup. March 21st, 1928. (302,529.)

12,358. "Automatic switching systems." British Thomson-Houston Co., Ltd. April 28th, 1927. (289,475.)

13,154. "Electric switches." I. Inaba. May 4th, 1928. (302,538.)

13,653. "Zinc-lead electric accumulators." A. Pouchain. May 19th, 1927. (290,665.)

15,004. "Pressure-applying devices for two or more concentric transformer windings." Akt. Ges. Brown, Boveri et Cie. May 23rd, 1927. (291,011.)

16,582. "Electric heating apparatus." C. G. Nobbs and W. W. Nobbs. June 7th, 1928. (302,550.)

16,900. "Arrangement for the electric control of railway points or other traffic-regulating devices which are required to remain in one position until each passing train completely clears them." W. J. Underwood. June 11th, 1928. (302,551.)

21,441. "Transmission of pictures." British Thomson-Houston Co., Ltd. July 25th, 1927. (294,546.)

25,060. "Vacuum cleaner with two impellers." Siemens-Schuckertwerke Akt. Ges. September 10th, 1927. (297,113.)

30,179. "Direction-finding aerials for use on aircraft." Telefunken Ges. fur Drahtlose Telegraphie. October 19th, 1927. (299,016.)

32,131. "Automatic or semi-automatic telephone systems." Associated Telephone and Telegraph Co., and J. Wicks. August 9th, 1927. (Divided application on 302,200.) (302,217.)

34,265. "Electric current-collecting brushes." Siemens-Schuckerwerke Akt. Ges. November 25th, 1927. (301,084.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from the dates mentioned:—

DECEMBER 26th, 1928.

Fultograph. No. 495,263. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—Wireless Pictures (1928), Ltd., 11, Bishopsgate, E.C.2.

Disto. No. 496,114. Class 50. Accumulator fillers made of celluloid.—La Société d'Exploitation des Produits Scientifiques, 56, Rue de l'Université, Paris. (British representative: Eric Potter, 11, Park Row, Nottingham.)

The Lightning Electric Slicer (lettering and design). No. 496,157. Class 6. Machines for slicing food.—British Weighers and Slicers, Ltd., Sheffield Road, Tinsley, Sheffield.

JANUARY 2nd, 1929.

Neolux. No. 495,659. Class 13. Chandeliers, lamp shades and supports, electric light fittings, &c.—Louis Dernier & Hamlyn, Ltd., 23, Newman Street, W.1.

Mammoth lamps (lettering and design). No. 480,659. Class 13. Electric lamps (ordinary).—Martin Fraenkel, 5, Siegmundshof, Berlin. (British representatives: Salop Pottery, Ltd., Broseley, Shropshire.)

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ALTRINCHAM.—Extension of the County High School for Boys (deposit £1 1s.); F. A. Browne, county architect, Newgate Street, Chester.

AMPTHILL.—Additional 62 houses, for the R.D.C.; surveyor.

AYRSHIRE.—College, for the governors of West of Scotland Agricultural College; Principal Paterson.

BALA.—Extensions, County School for Boys (£6,500); Merioneth Education Committee.

BOLTON.—Works extensions, New Holder Street; Pilkington Bros.

BRADFORD.—Street improvement, with new building, Leeds Road and Bridge Street site; city engineer.

BURNHAM (BUCKS.).—Houses (32), for J. E. Shuttleworth. Four factories, for Slough Estates, Ltd.

BURY (LANCS.).—Extensions, technical college, for the T.C.; borough engineer.

CARDIFF.—Baptist church, Rumney; trustees.

CARSHALTON.—Two schools (1,000 places), for Surrey E.C.; W. W. Finny, secretary, Kingston-on-Thames.

COVENTRY.—Works extensions for the Maudslay Motor Co., Ltd.; T. D. Griffiths, architect, Hertford Chambers.

DAGENHAM (ESSEX).—Motor manufacturing factory (300-acre site), for Ford Motor Co., Ltd.

DONCASTER.—Four schools (1,760 places), for the borough E.C.; W. Bagshaw, clerk. .

DUNDEE.—Shopping centre at Craigiebank housing scheme (£9,500); city architect.

DUNSTABLE.—Works extensions, High Street South, for Cross & Co., manufacturing stationers.

EPSOM.—Clinic, Chase estate (£2,945), for Surrey E.C.; Education architect, Kingston-on-Thames.

FILEY.—Extensions, Hunmanby Hall Secondary School for Girls (£18,000); Wesleyan Methodist Association.

GLASGOW.—492 tenement houses at Haghill, for Corporation (£150,000); director of housing, City Chambers. Cinema; J. Mackissack, architect, West Regent Street.

GUILDFORD.—Technical school; director of education.

HORSFORTH.—Housing scheme (30); surveyor to U.D.C.

HUDDERSFIELD.—Rebuilding business premises, King Street, with electric passenger lift for four floors, and central heating, for Messrs. Alfred Kaye, drapers; Abbey & Hanson, architects, Cloth Hall Street.

HULL.—150 houses, Charterhouse estate; city architect. 34 houses, Westcott Street; city architect. Flats on three sites; city architect.

ILKESTON.—Estate development, off Park Drive; Sir A. Ball.

INVERNESS.—Cinema (£16,000), for Highland Cinema Co.; the secretary.

LEEDS.—76 houses and 36 flats, Hawksworth Wood estate; city engineer. Rehousing scheme, Southfield estate: city architect. Shops and offices, New Street; G. W. Atkinson, architect. Elementary school, Oakwood Lane; Education Committee.

LIVERPOOL.—Housing schemes, Clubmoor (78) and Fazakerley Hall (102) (deposit £2 2s.); acting director of housing, Municipal Buildings, Dale Street.

LONDON (ILFORD, E.).—Tuberculosis dispensary, Cranbrook Street; Essex C.C.

(WEST HAM, E.).—Mental Home, South Ockendon, for the T.C.; borough engineer.

(E.C.).—Premises, Tudor Street; Associated Newspapers, Ltd. Buildings, 29-30, Newgate Street; Moorgate Trust, Ltd., and J. Grossmith & Son, Ltd.

(HORNSEY, N.).—Block of 33 flats (£12,000), for the T.C.; borough surveyor.

LONDON (*continued*).

(ELTHAM, S.E.).—Three-storey school, Ealdham Square, for the L.C.C. Education Committee; director of education.

(SOUTHWARK, S.E.).—Town hall extension; Town Hall Committee.

(WIMBLEDON, S.W.).—Swimming bath, Park estate; borough engineer. Reconstruction, 67, 67a and 69, The Ridgway; E. Iles.

LOUGHTON.—Extensions, high school (£18,820); Essex county architect.

MARKET HARBOROUGH.—Extensions, factory, St. Mary's Road; Harboro' Rubber Co.

MITCHAM.—Two central schools (£37,000); elementary school, Galpins Gardens; extensions, Lonesome School (£5,000); Surrey Education Committee.

MORECAMBE.—Garage, for Stansfield & Sutcliffe, Pedder Street; R. Dobson, architect.

NELSON.—Extension of the town hall; borough engineer.

NORTHALLERTON.—Extensions, County Hall (£12,118), for North Riding C.C.; building surveyor.

ORSETT (ESSEX).—Housing scheme (50), Aveley, for the R.D.C.; surveyor.

OSWESTRY.—Housing scheme (50), St. Martins, for the R.D.C.; surveyor.

PERTH.—Extension scheme (£20,000), for directors of Perth Infirmary; the medical superintendent.

RAMSGATE.—Development of Station site, with band enclosure, baths, shops, &c., for the T.C.; A. Minoprio and Hugh C. C. Spenceley, architects, London. Ladies' pavilion, for the T.C.; W. E. Healey, architect, 119, Grange Road.

RENFREWSHIRE.—Works at Grahamston Foundry, for Grahamstor Hosiery Manufacturing Co., Ltd.; the secretary.

ROTHERHAM.—Housing scheme (300), Herringthorpe (deposit £2 2s.); borough engineer.

RUGBY.—Mineral water factory, for Burton & Co.; Willard and Son, architects.

RYDE.—Bank, High Street; London County and Westminster Bank, Ltd.

SALFORD.—Exhibition hall, for a local company; particulars from Councillor J. F. Emery, J.P.

SHEFFIELD.—Workshops for blind (£27,750); housing scheme at Greenhill; further houses, Wybourn estate; city architect. 22 houses, Dykes Hall estate; James Laver and Sons, Ltd.

SMETHWICK.—Extensions, Dartmouth Road works; Birmingham Aluminium Casting Co., Ltd. Extensions, Surrey Works; Evered & Co., Ltd. Works extensions, Beakes Road; World's Wear, Ltd. Central clinic (£12,000); Education Committee.

STIRLINGSHIRE.—Administrative offices, for Stirlingshire Education Authority; architect, Education Authority, Stirling. School at Falkirk (£80,000), for Stirlingshire Education Authority; Mr. Malcolm, architect, Stirling.

STOCKTON-ON-TEES.—Central stores, Wellington Street, for the Co-operative Society; Townsend Gray, architect, Co-operative Wholesale Society, Newcastle-on-Tyne.

THORNBURY (GLOS.).—Additional 54 houses, for the R.D.C.; surveyor.

TRURO.—Hostel, Royal Cornwall Infirmary, with electrical work (£3,000); Cowell, Drewett & Wheatly, architects; J. Williams & Co., builders, St. Austell.

UPTON-ON-SEVERN.—Extensions to Institution (£11,600), for the Board of Guardians; clerk.

WALSALL.—Extensions, school of art (£2,777), for the borough E.C.; Director of Education.

YORK.—Public hall, exhibition buildings site; city engineer. Machine shop, Hull Road; York Engineering and Foundry Co.